SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, AUGUST 17, 1906.

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THE ITHACA MEETING OF THE AMERICAN CHEMICAL SOCIETY. I.

THE thirty-fourth general meeting of the American Chemical Society met in the chemical laboratory of Cornell University, at Ithaca, N. Y., on June 28–30. The society met partly in general session and partly in sections as follows:

Inorganic Chemistry: L. M. Dennis, chairman.

Organic Chemistry: G. B. Frankforter, chairman.

Physical Chemistry: W. Lash Miller, chairman.

Industrial Chemistry: J. D. Pennock, chairman.

Biological Chemistry: Waldemar Koch, chairman.

Agricultural and Sanitary Chemistry: E. B. Voorhees, chairman.

On Thursday evening there was a complimentary smoker given to the society by the Town and Gown Club. On Friday afternoon the members of the society attended the dedication of the Rockefeller Physical Laboratory. Following this, they left for an excursion to a hotel on Cayuga Lake, where dinner was served at 7:30. On Saturday morning Dr. E. Haanel, of the Department of Mines, Ottawa, Canada, gave an address on 'Electric Smelting Experiments at Sault Ste. Marie.' One hundred and thirty-two members of the society were in attendance on the meeting, which was a most enjoyable and successful one. The following are abstracts of papers which were presented:

GENERAL SESSION.

AFTER a brief address of welcome by Dean T. F. Crane and a response by President W. F. Hillebrand for the society, the following addresses were given:

The Terpenes and Colophonium with Some of Their Industrial Chemical Problems: G. B. FRANKFORTER.

The author in cooperation with students has been studying the terpenes and colophonium for a number of years. The pine family of the north and west has been

studied both from the strictly chemical and from the industrial standpoints. Large numbers of analyses of the wood of the Norway pine and the Douglas fir as to the amount of both the terpenes and colophonium were made. The stumps and roots of these species were likewise exhaustively studied. A chemical examination of the terpenes indicated that the common terpene present differed from the pinene of the southern pine, the boiling-point being lower, the optical properties and the compounds formed being different. A new series of compounds, the chlor-hydrochlorides, has been made both from the terpenes above mentioned and from common pinene. The colophonium from both the Norway pine and the Douglas fir has been shown to consist of two different acids. These acids are being carefully studied.

Harcourt and Esson's Method in Chemical Mechanics: W. Lash Miller.

As the rate of a chemical change in a homogeneous solution depends on the temperature and on the concentrations of the dissolved substances, measurements of the rate are best made in solutions whose temperatures are kept constant by means of a thermostat and in which the concentrations are kept constant by dissolving quantities large in comparison with those generated or destroyed during the reaction. In 1866 Harcourt and Esson measured rates of change in solutions containing a large excess of each of the reagents but one. Although they pointed out the advantages of this method of working, their example was not followed. Hood, in 1878, used in excess each but two of the reagents; van't Hoff ('Études,' 1884) used equivalent quantities and compared the results of experiments with different initial concentrations; while from 1885 to 1895 it was the custom to work with more or less equivalent concentrations and to deduce the 'order' of the reaction from a series of analyses. By this time the method of Harcourt and Esson was forgotten. In 1895 A. A. Noyes resuscitated van't Hoff's method; in 1901 Ostwald proposed a method which somewhat resembles Harcourt's; and in the same year Harcourt and Esson's way of working was revived in the laboratory of the speaker, where the principles of the method have been extended (method of constant rates) and applied to the study of chemical equilibrium (arsenic and iodine). The power of Harcourt and Esson's method as a tool of research was illustrated by a number of examples.

Some Problems for Agricultural Chemists: E. B. Voorhees.

This paper is historical and suggestive, rather than containing the results of definite experiments. It points out the conditions heretofore existing in this country, which have encouraged agricultural chemists to demonstrate the principles already understood, rather than to investigate. Notwithstanding the larger use of commercial fertilizers in the east, and better farming methods in the west, there is an apparent exhaustion of soils, which calls for scientific investigation of those problems connected with the soil and its fertility.

The nitrogen question is supreme, notwithstanding the discoveries that have recently been made, in reference to both the symbiotic appropriation of nitrogen, and its abstraction from the air by electric means.

The Occurrence of Boracic Acid in Death Valley, California, and in Tuscany: Edward Hart.

This was a description of two trips, one to Death Valley in 1902–3 and one to the soffoni of Tuscany in May, 1906. The boric acid occurs near Daggett, California, as colemanite, $Ca_2B_6O_{11}$, and as calcium

borate in borate mud. The colemanite is sent to Bayonne, N. J., and converted into borax. The borate mud is treated at Daggett with sulphur dioxid and the boric acid crystallized out and shipped. In Tuscany the boric acid vapors are passed into water which is then evaporated. The vapors from driven wells have a pressure sometimes of nine atmospheres and after purification are used for driving steam-engines. Nearly pure ammonium sulphate is also produced.

AGRICULTURAL AND SANITARY CHEMISTRY.

E. B. Voorhees, chairman.

The Improved Refractometer Slide Rule and its Application: ALBERT E. LEACH and HERMANN C. LYTHGOE.

The refractometer slide rule was first described in the *Jour. Am. Chem. Soc.*, in 1904. Since then it has been somewhat improved and is now on the market. It is designed for the use of oil and food chemists who have occasion to employ the butyro or the Abbé refractometer. It readily converts indices of refraction (which the Abbé instrument reads directly) into degrees on the butyro-refractometer, and *vice versa*. It also enables one to transfer scale readings or refractive indices taken at any temperature into their equivalent at any other, thus avoiding troublesome calculations.

Comparative Effect of Organic and Mineral Matter in Soil-extract Cultures: OSWALD SCHREINER.

A series of experiments with wheat and other seedlings is reported in which the effect of the organic and inorganic constituents of the soil solution and of organic manures are studied. It is shown that the toxic effect of certain soil extracts is not entirely overcome by fertilizer salts, but is more markedly affected by organic substances, such as pyrogallol, the organic matter from ordinary stable manure, etc., as well as by treatment with certain other non-nutrient substances, or even by mere boiling of the extract, indicating the presence of volatile or thermolabile organic substances. Results are obtained by separating the organic and inorganic portions of a stable manure extract and studying the effect of the various fractions on wheat seedlings. The results show that the organic substances play a very large part in the effectiveness of the extract, and more especially through an action other than that of nutrition.

Chemical and Bacteriological Factors in the Ammonification of Soil Nitrogen: JACOB G. LIPMAN.

It is well known that organic nitrogen, either as applied in manures and fertilizers, or as forming a part of the soil humus, is utilized to an unequal extent in different soils. Since the crops growing on any soil do not derive their nitrogen food directly from the nitrogenous organic compounds, but make use of them only after they are changed into more simple substances in the processes of decay, it follows that the unequal utilization of the organic nitrogen, in different soils, is intimately related to the quantitative and qualitative differences in the development of certain classes of soil organisms. On the other hand, the soil bacteria are themselves influenced in their growth by the chemical and physical constitution of the soil; and the simplification of organic compounds in arable lands is, therefore, a function of both chemical and bacteriological activities. It is shown that when 100 c.c. of a ten per cent. solution of peptone is inoculated with ten grams of fresh soil the rapid transformation of the peptone nitrogen takes place. On distillation with excess of magnesia a large portion of this peptone nitrogen distils over as ammonia.

The amount of ammonia depends on the nature of the soil. The question arises as to the reason why one soil will lead to the formation of more ammonia than another soil under the same conditions. Are the differences due to the numbers or kind of bacteria or are they due to variations in the chemical composition of the soil? Experiment has demonstrated that the bacteriological factor has been found to play the predominant rôle in the ammonification of soil nitrogen and that it is itself directly affected by the chemical composition of the soil.

The detailed results of these studies will be reported in the *Journal of the American Chemical Society.*

Composition of the Drainage Waters of Some Alkali Tracts: F. K. Cameron.

It was shown how the analysis of a drainage water could be used in interpreting the changes taking place in alkali soils under drainage. Illustrations were given, on the one hand, showing that the same salts present in the soil remain, though the total amount had been diminished, and on the other hand, illustrations were given where not only the amount of salts, but the particular kinds of salts, had changed.

Nutrition Investigation of the Office of Experiment Stations, and the Results of Some Recent Work: C. F. Langworthy.

The purpose and scope of the human nutrition investigation carried on under the auspices of the Office of Experiment Stations of the Department of Agriculture, were briefly outlined, particularly the work of the fiscal year 1905–6, and the results of some dietary studies with aged men and women were summarized. From the data presented and a summary of similar work, the factor nine tenths was proposed as representing the amount consumed by a man past middle life, as compared with a man in full vigor at moderate muscular work.

Keeping of Tobacco: J. M. Bell.

This article has been published in full in Science, June 16, 1906.

A Method for the Determination of the Lead Number in Maple Syrups and Maple Sugar: A. L. Winton and J. Lehn Kreider.

The method proposed is based on the well-known fact that lead subacetate produces a voluminous precipitate in genuine maple products, whereas in products adulterated with refined cane sugar the amount is deficient. A solution of 25 grams of the material is precipitated with 25 c.c. of standard lead subacetate, made up to 100 c.c., filtered, and the lead determined in 10 c.c. of the filtrate. The amount of lead consumed in forming the precipitate is found by difference. This expressed as per cent. of the material is the 'lead number.' The lead number in samples of maple syrups of known purity was not less than 1.20, but in adulterated samples it ranged from 0.02 to 0.92.

The Application of Colorimetric and Other Delicate Analytical Methods to the Study of Agricultural Problems: Ostwald Schreiner and J. F. Breazeale. (By title.)

Legume Bacteria and Soil Fertility: Karl Kellerman. (By title.)

Toxicity of Some Ammonium Salts on Wheat Seedlings in Solution Cultures: Charles A. Jensen. (By title.)

A Preliminary Study of the Combinations of Acids with Casein as determined by Conductivity Measurements: L. L. Van Slyke.

For more than half a century there has been at issue a question as to whether or not the coagulum formed when milk sours or is acted on by acids is a combination of casein and acid. As the result of work carried on in the Geneva Station Labora-

tory by Mr. E. B. Hart and myself satisfactory evidence was produced to show that casein can and does combine with acids to form insoluble casein salts. An attempt was made to settle the quantitative side of the question by suspending free casein in a given amount of dilute acid of known strength, filtering and determining the amount of acid left uncombined. This method was found to be inadequate. It then occurred to the writer that results might be obtained by suspending free casein in dilute acid and then testing the filtrate for changes of electrical conductivity. This work is being done largely by Mr. Donald D. Van Slyke.

The conductivity method shows that the base-free casein forms an insoluble compound with dilute hydrochloric acid, which slowly combines with more acid forming a soluble compound. This soluble compound forms more readily with more concentrated acid and is unstable, being readily decomposed by bases with precipitation of a compound probably pure casein. Further the conductivity method shows that the amount of acid combined with casein is considerably in excess of that found by the method first used and that the low results are accounted for by the formation of this soluble compound.

The work is still unfinished and many other phases will be studied.

Movement of Water and Solutions in Soils: F. K. CAMERON and J. M. BELL.

It has been pointed out in Bulletin 30, Bureau of Soils, that the movement of water in capillary media is described by the empirical formula,

$$y^n = Kt.$$

Further experiments show that in case of the movement of water through a capillary tube n is equal to 2. A theoretical deduction of this formula has been given.

Relation of Sodium to Potassium in Soil and Solution Cultures: J. F. BREAZEALE. (By title.)

The Distribution of Soluble Bodies between Water and Soils, or other Finely-divided Solids: F. K. CAMERON and H. E. PATTEN.

It has been shown that the rate of absorption generally follows the law expressed by the equation

$$\frac{dy}{dt} = K(C - y),$$

which is the equation describing a reaction of the first order. The distribution of substances, both organic and inorganic, between a soil or other absorbing material and the solvent was studied, and it was found in a majority of cases that the curves were of a logarithmic character, which appears to be expressed by the empirical formula,

$$\log \frac{y}{C - y} = K_x.$$

Several cases were found, however, which were better expressed by a linear equation. It was shown that the soils and other absorbing media have a maximum saturation capacity, C in the above formula, which has an important significance from an agricultural point of view.

Abnormal Transpiration in relation to Growth in Wheat under Certain Conditions: OSWALD SCHREINER and CHARLES A. JENSEN. (By title.)

Superphosphates: F. K. CAMERON and J. M. BELL.

In the four-component system—lime, sulphuric acid, phosphoric acid, water, which are the essential constituents of superphosphates—five stable solids have been found at 25°, viz., monocalcium phosphate, dicalcium phosphate, anhydrite, gypsum and a series of solid solutions in phosphoric acid and lime. The inversion points and

the boundary lines of the fields have been determined. At 66°, however, the field for gypsum disappears. From these data there was shown the effect of leaching superphosphates by water at ordinary temperatures.

A Simple Fat-extraction Apparatus: G. S. Fraps.

The apparatus uses a mercury joint, and is simple and cheap.

Flavoring Extracts, Natural and Artificial, in Food Products: Edward Gudeman. (By title.)

A Colorimetric Method for the Determination of Absorbed Oxygen in Water: G. B. Frankforter and A. D. Wilhoit.

The importance attached to the amount of absorbed oxygen in a sanitary analysis of water led the authors to search for a colorimetric method which would be in line with sanitary methods in general, and which would at the same time be rapid and accurate. A method using cuprous ammonium chloride was finally adopted. The advantages of the method, however, are largely in the construction of the apparatus. After various oils and even perfect rubber stoppers were found to be inefficient in protecting the colorless cuprous ammonium chloride from oxidation by air, a special glass stopper was devised. This stopper with a siphon was fitted into the top of one of the Hehner cylinders so as to protect the water in the tube from the air and at the same time to be used as a colorimeter by making comparisons in the ordinary way. The manipulation is very simple. The glass cork is placed in the Hehner cylinder so that the lower end stands at 101 c.c. Then 100 c.c. of water under examination is allowed to flow in. By turning a three-way stop-cock 1 c.c. of cuprous ammonium chloride is added, when a blue color immediately appears depending in intensity upon the amount of free oxygen in the water. The color is matched in the second Hehner cylinder by cupric ammonium chloride of known strength and representing a known quantity of oxygen. With this apparatus very rapid and accurate determinations are possible.

The Estimation of Citral in Lemon Oil: E. Mackay Chace. (By title.)

ORGANIC CHEMISTRY.

G. B. Frankforter, chairman.

The Fruit of Smilacina racemosa and trifolia: Nicholas Knight.

The purpose of the work was, as far as possible, to determine the composition of the fruit. The berries were gathered between August 15 and September 5, 1905, at Sylvan Beach, N. Y., on the shore of Oneida Lake. They were allowed to ripen in the house. At first they were green in color and the fruit of the *racemosa* were about the size of peas, the fruit of the *trifolia* being smaller. As they ripened both species became of a reddish color, resembling currants. The *racemosa* fruit contains free tartaric and a small quantity of citric acid, a red coloring matter and glucose. The nutlets or kernels were ground and digested with boiling alcohol, by which an oil or possibly two oils were received. These were investigated. The fruit of the *trifolia* showed a similar composition, the main difference being potassium tartrate in place of the free tartaric acid.

The Constitution of Paris Green and its Homologues: S. Avery.

The writer shows by a review of the literature that great uncertainty exists in regard to the constitution of these substances. Many years ago Ehrmann found that a commercial sample of Paris green (Schweinfurt green) consisted of three molecules of copper meta-arsenite in chemical combination with one molecule of cop-

per acetate. Later Wöhler made a green starting with copper butyrate and found the ratio to be 2:1. The writer shows that Paris green and its homologues may be regarded as isomorphic crystalline mixtures in which the extreme limits of the ratio of copper arsenite to the copper organic acid salt lie between 3:1 and 2:1. This view is confirmed by the study of greens, samples of which have been made containing a great diversity of organic acids. It is further confirmed by a study of certain zinc arsenites.

A Chemical Study of Curare: G. B. FRANKFORTER and H. M. NEWTON.

The authors have made an exhaustive examination of the various forms of curare, or arrow poison. It required several years to collect these samples in the crude form as prepared by the Indians. On one or two occasions the bulbs or original containers had been partly filled with sand by the Indians, only a small amount of the alkaloid having been placed on the top of the sand. The analyses of these samples varied widely in composition. The amount of inorganic matter varied from 15 to 68 per cent., and in one or two cases the substance was found to be perfectly inert, physiologically. Reactions indicated an alkaloid with marked basic properties. No crystallized compounds were made, but analyses of the base prepared from the platinum double salts indicated that the formula for the alkaloid, notwithstanding the fact that it is used extensively as a medicine at the present time, is still in doubt. The formula given for the free base by Sachs was obtained from an analysis of the platinum double salt. The formula of Preyer has been shown to be incorrect, as the material analyzed contains a large amount of inorganic matter. From the work already done, the authors conclude that the free base in curare or curarine is more complex than the formula given by Sachs.

PHYSICAL CHEMISTRY.

W. Lash Miller, chairman.

Cooperation in Physical Chemistry: W. D. BANCROFT.

We could be of more assistance to each other if we had a system of reports by which we knew what bits of research work the others were doing. Each one of us has stored away in his memory a number of generally unfamiliar facts which he has stumbled upon in his reading or in his laboratory. These may not be important enough to him to justify his doing enough work to get anything worth publishing, or he may have more important matters on hand and so lack the time. If now any one of us learns that any one of the others is doing a bit of investigation into which this, that, or the other fact fits nicely, the observation can at once be turned over to the man who can use it, much to the benefit of both parties.

It is probable that nobody goes to one of the meetings of the Chemical Society without getting a few suggestions of value to him. On the other hand, owing to the great distances and consequent expense, we do not get together as often as we should like. If we kept more in touch, we should be getting continually some of the advantages which we now get from the occasional meetings. The matter would not be difficult to arrange. In October and February each man could make out a list of the work planned or in operation. These reports could be manifolded and distributed. So far as I can see, the plan has practically no objectionable features and might be of great value. It seems therefore worth trying.

Uniformity in the Use of Algebraic Symbols: W. LASH MILLER.

The desirability of a uniform system of symbols for use in works on physical, chemical and engineering subjects has often been urged; and various systems have been suggested, one of them by a former president of this society.

The latest proposal, made by Linders in his pamphlet 'Die Formelzeichen,' Leipsic, 1905, is very ambitious, and involves the use of German and Russian type in addition to the Greek and Latin alphabets. Would it be more practical to divide the sciences into groups, and to fix on a uniform system of symbols for use in each group, without insisting that a letter to which one meaning has been assigned in geometry, for instance, should not be employed with another meaning in chemistry? Is it desirable to appoint a committee to consider the whole question and report at a subsequent meeting?

The Influence of Calcium on Iron: O. P. Watts. (By title.)

The Electrical Conductivity of Solutions of the Alcohols in Liquid Hydrobromic Acids: E. H. Archibald.

Qualitative tests were first made to see what classes of the alcohols would dissolve in this solvent to give conducting solutions. The liquid acid is found to be very selective as regards the bodies which it will dissolve, being a solvent for one alcohol but not for another, although they differ but little in constitution. The conductivities of solutions of some fourteen of the alcohol bodies have been measured quantitatively over a considerable range of dilution. In the case of the greater number of the solutions the temperature coefficients have also been determined. The molecular conductivity in nearly all cases increases rapidly with the concentration. In a few instances for the more dilute solutions of the simpler alcohols the molecular conductivity either decreases slightly with the concentration or remains practically constant. As far as these investigations have extended those bodies which dissolve conduct the electric current. The temperature coefficients are in some cases positive, in some cases negative.

The Electrical Conductivity of Solutions of the Organic Acids in Liquid Hydrobromic and Hydrochloric Acids: E. H. Archibald.

Qualitative tests of about twenty of the organic acids showed that quite a number would dissolve in both solvents to give conducting solutions. As far as can be ascertained those acids which dissolve to any extent give solutions which will conduct. The quantitative measurements show that the hydrochloric acid solutions have by far the greater conducting power, at least in the case of nearly all the bodies examined. The molecular conductivity for both solvents, except in a few cases for the very dilute solutions, increases with the concentration. The temperature coefficients in all the cases examined are positive.

The Identification of Insoluble Phases: L. F. Hawley.

By means of the solubility method the formula $2PbCO_3 . Pb(OH)_2$ for the basic carbonate of lead was confirmed. Mixtures of lead carbonate and oxide in varying proportions were treated with a 20 per cent. sodium acetate solution and the amount of lead dissolved in 50 c.c. was determined. The oxide was found to hydrate in the presence of the carbonate until sufficient hydroxide was formed to give $2PbCO_3 . Pb(OH)_2$. The solubility remained constant over a range of concentrations up to two molecules of the carbonate to one of the oxide, and with more than two of the carbonate to one of the oxide the solution was also constant, but at a lower value. This shows the presence of a compound with a formula corresponding to the

concentration at which the solubility changes.

Another method was used in the identification of the insoluble phases formed when thallium sulphide and stannic sulphide are precipitated together. Since the phases have different colors the appearance or disappearance of a phase can be readily observed under the microscope. From pure Tl_2S up to a concentration corresponding to Tl_4SnS_4 two phases can be distinguished, the black Tl_2S, and the red Tl_4SnS_4; from this point up to 76 per cent. SnS_2 two phases are present, the red Tl_4SnS_4 and a reddish yellow transparent phase, while beyond 76 per cent. SnS_2 all concentrations are homogeneous, showing a solid solution.

The Equilibrium between Ammonia and Hydrogen Sulphide: J. P. MAGNUSSON.

The reaction

$$NH_3 + H_2S \rightleftarrows NH_4SH$$

was studied at 20° over a range of 95 cm. partial pressure. The mass-law formula

$$p_{NH_3} \times p_{H_2S} = \text{const.}$$

describes this equilibrium over the pressure range studied if the pressure of the undissociated NH_4SH is neglected and if corrections are made for the deviations of the gases from Boyle's law. For hydrogen sulphide this deviation was found to be within the limit of experimental error over the pressure range studied, but for ammonia the deviation was considerable at the higher pressures. This was shown to be due to the adsorption of the gas on the glass surface of the measuring tube and on the NH_4SH crystals. The adsorption of gases on the walls of the containing vessel has an important bearing on our conception of the so-called imperfect gases.

The Precipitation of Lead Chromate: EDWARD E. FREE.

Precipitations were made from equivalent solutions of $Pb(NO_3)_2$ and K_2CrO_4 under as nearly as possible equal conditions. The rapidity of precipitation is greater from hot solutions and more concentrated ones. The crystals are large when the solutions are hot and dilute. The presence of glue greatly retards precipitation. The color is apparently the same under all conditions of precipitation, provided the solutions are neutral. Alkali will impart an orange tinge due to basic chromate. Minor accidental variations in the manner of precipitation have a great influence.

Solubility of the Phosphates of Magnesium: F. K. CAMERON and J. M. BELL.

The behavior of calcium phosphates in contact with water and with phosphoric acid solutions has already been studied in this laboratory by Cameron, Seidell and Bell. It was found that at 25° only two calcium phosphates exist in equilibrium with aqueous solutions. At the higher concentrations monocalcium phosphate is the stable solid phase, and at intermediate concentrations dicalcium phosphate is the solid phase. At very low concentrations there is at least one series of solid solutions. The behavior of magnesium phosphates in contact with water and with phosphoric acid solutions has been studied in a similar way at 25° C. Here there are but two magnesium phosphates, the monomagnesium phosphate, which exists in contact with solutions containing above 700 grams of P_2O_5 per liter; below that concentration the stable solid is dimagnesium phosphate. The solution in contact with the above phosphates of calcium contains about 320 grams of P_2O_5 per liter, while that in contact with the phosphates of magnesium contains over 700 grams of P_2O_5 per liter.

The System Water-Gypsum-Lime: F. K. CAMERON and J. M. BELL.

The mutual solubility of gypsum in lime solutions and of calcium hydroxide in gypsum solutions has been determined at

25° C. The solubility of gypsum in lime solutions is depressed with increasing amounts of lime, while the solubility of lime in gypsum solutions shows very slight increases. The solution in contact with both calcium hydroxide and gypsum contains 1.59 grams $CaSO_4$ per liter and 1.22 grams of calcium hydroxide per liter. A solution containing calcium hydroxide alone contains 1.17 grams per liter and a solution containing gypsum carries 2.13 grams of calcium sulphate per liter. There is no basic sulphate of calcium at this temperature.

The Solubility of Gypsum in Phosphoric Acid Solutions: W. C. Taber.

The solubility of gypsum in several acids, notably hydrochloric, nitric and sulphuric, has already been studied. In this investigation of its solubility in phosphoric acid it was found that at 25° C. small amounts of phosphoric acid increase the solubility of gypsum to a marked extent, the solubility being greater as the concentration of the acid increases. At about 230 grams of P_2O_5 per liter there is a maximum solubility of about four times that in pure water. Above this concentration the solubility decreases regularly with increase of the acid content. The results of these experiments are in accord with other work on the solubility of gypsum in solutions of electrolytes which contain no ion in common with gypsum.

The Phosphates of Iron and Aluminum: F. K. Cameron and J. M. Bell.

Crystalline phosphates of iron and of aluminum have been found to exist in solutions which contain high percentages of phosphoric acid. At lower percentages the precipitates appear to be solid solutions.

The Solubility of Nitric Oxide and of Air in Sulphuric Acid: O. F. Tower.

The method of Bunsen was used, which consists in shaking the respective gas with sulphuric acid in a eudiometer tube, which is standing in a mercury bath.

The following are the results obtained:

Concentration of Sulphuric Acid.	Coefficient of Solubility In Nitric Oxide.	In Air.
98 per cent.	No constant results obtained.	0.0173
90 per cent.	0.0193	0.0107
80 per cent.	0.0117	0.0069
70 per cent.	0.0113	0.0055
60 per cent.	0.0118	0.0059
50 per cent.	0.0120	0.0076

These numbers are so small that the solubility of these gases in sulphuric acid can cause no appreciable error in the determination of nitrates, nitrites or the oxides of nitrogen by Lunge's method, unless excessive quantities of sulphuric acid are employed.

The Basic Solutions of Beryllium Sulphate: Chas. L. Parsons and W. O. Robinson.

Solutions of the normal salts of beryllium have the property to an unusual degree of dissolving large amounts of their own hydroxide or carbonate. The present paper deals with such basic solutions of the sulphate. Freezing-point determinations, on both dilute and concentrated solutions, show that, per mol. of SO_3, any increase in basic ratio over the normal raises the freezing-point. The osmotic effect of the sulphate is, therefore, always decreased by dissolving in it its own hydroxide. The electrical conductivity of the basic solutions is less than that of normal solutions containing the same amount of SO_3. Migration experiments show that beryllium forms no part of the anion. The basic solutions are not precipitated by crystalloids; but on dialysis hydroxide is left on the membrane, and the dialyzed solution has a lower basic ratio.

Further Study of the Sulphates of Beryllium: Chas. L. Parsons and Carl T. Fuller.

In the earlier work of one of us, it was found impossible to procure crystals from solutions of the sulphate having a basic ratio greater than BeO/SO_3. Crystals have now been obtained from solutions with a ratio as high as $3BeO/2SO_3$. These crystals are in every case the normal tetrahydrate, and by their separation the mother-liquors are rendered more basic. Repeated attempts to obtain the hexa-hydrate described by Levi-Malvano (*Ztschr. anorg. Chemie*, **48**, 446) have resulted in failure. Although the conditions described by that author were faithfully followed and other methods used, the tetrahydrate invariably separated. A series of experiments on dialyzing the sulphate solutions of a basic nature showed a tendency for the solution to become much less basic by dialysis and the hydroxide was left behind.

The Theory of the Dissociation of Gases around Highly Heated Wires: IRVING LANGMUIR.

In a previous paper the author gave the results of experiments on the dissociation of water vapor and carbon dioxide, made by passing the gases over glowing platinum wires. The present paper shows that under ordinary conditions dissociation phenomena take place so close to the surface of the wire that convection currents do not influence the dissociation. The temperature of the gas near the wire is then calculated from the heat conductivity and the heat given off by the wire. Taking into account the diffusion and the variation of the dissociation constant and of the velocity coefficient with the temperature, a formula is derived which enables one to calculate the difference between the dissociation for equilibrium at the temperature of the wire and the dissociation actually observed after passing the gas over the wire. Applying the formula to the results of the experiments, it is shown that this difference can not exceed 10^{-10} per cent. or only 10^{-5} of the actual dissociation. Therefore the only remaining source of error in the experiments was in the determination of the temperature of the wire and in the analysis of the gases. The results for the dissociation may be considered quite accurate.

The Lime-Silica Series of Minerals: ARTHUR L. DAY and E. S. SHEPHERD.

There are two definite compounds of lime and silica which can exist in contact with the melt: (1) the pseudo-hexagonal metasilicate, melting at 1,512° and inverting to wollastonite at about 1,200°; (2) the orthosilicate of calcium, melting at 2,080° and possessing three polymorphic forms, which have been given the names α, β and γ, in the order of their formation. The α form is monoclinic, density 3.27, hardness 5; the β form is orthorhombic, with about the same density; the γ form has a density of 2.97 and also crystallizes in the monoclinic system. The inversion point α to β occurs at 1,415°; β to γ at 675°. There are three eutectics in the series, tridymite + metasilicate at 35 per cent. CaO, 1,417°; metasilicate + orthosilicate at 54 per cent. CaO, 1,430°; orthosilicate + lime at 67½ per cent. CaO, 2,015°. The constants of the original components are these: pure fused lime has a density of 3.32, hardness 3 +. The fusion temperature is unknown. Lime crystallizes in the isometric system and no polymorphic forms were found. Silica melts very gradually, beginning at about 1,600°, to an ultraviscous liquid. The melting point, like those of albite and orthoclase, is, therefore, indeterminate. At all temperatures above 800° quartz changes to tridymite and quartz glass crystallizes as tridymite, so that above this temperature tridymite is unquestionably the stable phase. The density of pure artificial tridymite is 2.320 (25°); that of quartz glass, 2.213 (25°); the purest natural quartz

has a density of 2.654 (25°). Neither $Ca_2Si_3O_8$, $Ca_4Si_3O_{10}$ nor $3CaOSiO_2$ can exist in the two-component system.

The Effect of Acetone on the Transference Numbers of Sodium and Potassium Chlorides: H. F. Lewis.

It has been found that in general a change of solvent has little or no effect on the transference number of a salt, but no experiments have been published in which acetone was used. In the present investigation the apparatus was a large inverted U tube, the legs of which dipped into large test tubes; by means of a small tube blown into the top or bend of the U tube it was possible to withdraw a sample of the middle portion for analysis. Although the apparatus is not at all adapted to very accurate work, it was shown by blank measurements and tests with indicators that the method was sufficiently good to guarantee that the large differences found are not due to errors. A silver voltameter was used to measure the total decomposition. The cathode portions were analyzed by titrating with deci-normal silver nitrate. The middle portion changed in almost all cases less than one per cent.

	Parts of Acetone.	H	No. of Exp.
NaCl	0	.59	1
	⅛	.55	2
	¼	.52	2
	½	.38	2
	¾	.38	2
KCl	0	.49	5
	⅛	.44	1
	¼	.40	3
	½	.37	3
	¾	.31	4

In the above table of results the first column gives the parts of acetone in one of solution; the second column gives the transference number of the chlorine, and the last column gives the number of independent experiments on which the result is based. The experiments were carried out at room temperature; and all the solutions were approximately deci-normal with respect to the salt.

The Electrode Capacity of Iron and its Bearing on Passivity: C. McC. Gordon and Friend E. Clark.

The oldest and most commonly accepted explanation of the passivity of iron carries with it the idea that it is due to a very thin oxide sheet. In later years several other hypotheses have been suggested, which, while perhaps better fitted to explain many of the existing conditions, have not entirely displaced the oxide theory. In case we assume the oxide theory we might expect the so-called passive iron to act as an electric condenser; the conducting iron and the conducting solution being separated by insulating oxide, similar to films on aluminum anodes. Measurements of this capacity—comparing it on the Wheatstone bridge with a metallic condenser of known capacity—have been made for iron electrodes in various solutions, with the following results:

(1) Passive iron (electrodes) acts as if covered with a sheet of oxide, as is evidenced by the following facts: (*a*) The electrodes have a capacity easily measured while active electrodes (that is, iron in dilute nitric acid or freshly deposited electrolytic iron) show no signs of such capacities. (*b*) The capacity values are about of the same order of magnitude as those of aluminum, where we certainly know there is such capacity. (*c*) Electrodes oxidized in a Bunsen burner flame give a similar capacity. The oxidized sheet, so formed, appears to be five or six times as thick as that of the electrodes made passive by the concentrated nitric acid. It is notably different, too, in that it has a small resistance. It acts like a leaky condenser, or a condenser in parallel with a resistance. (2) Iron transferred from the air to neu-

tral solutions behaves qualitatively exactly like iron oxidized in the flame. Its capacity, however, is somewhat larger than that of the passive iron, indicating a thin film or sheet. The resistance of this sheet is relatively smaller, due, as we suppose, to small holes or crevasses in the sheet.

The Electrical Conductivity of Tungstate Solutions: ROGER CLARK WELLS.

A study of the conductivity of various tungstates showed that in the case of sodium metatungstate and ammonium paratungstate a partial transposition begins to take place as soon as those salts are dissolved in water. Although the rate of this transformation is very slow at 25°, it increases rapidly with rising temperature. This discovery will undoubtedly explain the queer solubility determinations which several investigators have found for these salts without considering the time factor.

Freezing-point Measurements: W. G. SMEATON.

The author takes up a consideration of the difficulties encountered in freezing-point determinations and then proposes a method which is a modification of the Raoult method. This modification is based on the fact that, although cryohydrates are theoretically ideal cooling baths, in practise their use necessitates the introduction of the Nernst and Newton constants. The use of these constants is made necessary because the temperature of the cooling bath can not be regulated to produce a temperature equilibrium in the freezing-point vessel at the apparent freezing-point of the solution in all cases. In applying the modification it is most convenient to use a mixture of ice and salt. An auxiliary cooling bath permits rapid determinations. The apparent freezing-point is first determined rapidly in the auxiliary cooling bath. Then the temperature of the cooling bath is regulated to give temperature equilibrium at the apparent freezing-point. In the meantime the ice has been thawed out of the freezing-point vessel which is undercooled in the auxiliary bath and then is transferred to the other bath. Inoculation is made when the temperature begins to rise uniformly. Thus the degree of undercooling is determined with the maximum of accuracy. Ice formation is prevented during undercooling by vigorous hand stirring. The method is rapid, easily manipulated, and gives accurate determinations with very small volumes of solution. The only correction to be applied arises from the change in concentration of the solution through the ice separated. The factor to be applied is a constant for a given apparatus under uniform conditions.

On Amorphous Sulphur; IV. Precipitated Sulphur: ALEXANDER SMITH and R. H. BROWNLEE.

This investigation deals with the proportions of amorphous sulphur ('supercooled $S\mu$') contained in sulphur which has been precipitated (1) from sodium polysulphide by the action of acids and of iodine, and (2) from sodium thiosulphate by the action of equivalent and excessive amounts of acids. The sulphur from polysulphides —so-called 'amorphous sulphur'—is almost wholly crystalline soluble sulphur. When the thiosulphate is used, different acids in equivalent concentrations give different proportions of amorphous sulphur. For a single acid the proportion increases more rapidly than the concentration of the acid. The proportion of insoluble sulphur seems to be greater the more rapid the action (due to high concentration of the acid), and therefore the smaller the droplets and the quicker the hardening of the precipitated liquid $S\mu$. Higher temperatures up to 25° hasten the action, and therefore give larger proportions of amorphous sulphur; but at 40° the tendency of $S\mu$ to revert to

$S\lambda$ asserts itself and the proportions are smaller.

On Amorphous Sulphur; V. Further Study of the Two Forms of Liquid Sulphur as Dynamic Isomers: Alexander Smith and C. M. Carson.

This investigation deals with (1) measurements of the rate of transformation $S\lambda \rightleftharpoons S\mu$ in presence of different catalyzers; (2) study of the influence of iodine, a second component; (3) investigation of freezing-point phenomena of $S\lambda$ and determination of the 'natural' freezing-point (114.5°); (4) thermal effects when liquid sulphur is heated rapidly; (5) measurements of concentrations of $S\mu$ when equilibrium has been reached at temperatures between 155° and 165°; (6) measurements of concentrations of $S\mu$ when liquid sulphur is being heated rapidly; (7) relations of viscosity to preceding results; (8) discussion of causes of the thermal effects and of the whole problem in the light of these results.

G. R. White,
Press Secretary.

(To be concluded.)

DOCTORATES CONFERRED BY AMERICAN UNIVERSITIES.

The degree of doctor of philosophy or doctor of science has this year been conferred, as shown in the accompanying table, on 325 students by institutions competent to award these degrees. The number in 1906 is exactly the same as in 1905, but these two years represent an advance over any preceding year, bringing the number of doctorates conferred during the last nine years to 2,387. These figures do not include those who have received the degree or its equivalent from foreign universities. No statistics are at hand in regard to these students, but the number is probably in the neighborhood of fifty annually. We have not the information that would enable us to say what percentage of those who take the doctor's degree continues to engage in research work and productive scholarship, but probably not more than one third. Neither are there any data showing what percentage of those who are engaged in the advancement of science and learning holds the doctor's degree, but it may be estimated at about half. In so far as these estimates are correct, there would be about 250 men a year added to those who will hereafter devote themselves with some success to research work, and of these about half will work in the exact and natural sciences.

It must be confessed that this number is disappointingly small when the population and wealth of the country are considered. Dr. W. T. Harris, in the last report of the

TABLE I.

DOCTORATES CONFERRED.

	1898	1899	1900	1901	1902	1903	1904	1905	1906	Total
Harvard.	26	24	36	29	31	28	46	38	46	304
Chicago	36	24	37	36	27	32	36	44	31	303
Yale	34	30	26	39	29	36	39	34	29	296
Columbia	22	33	21	25	32	39	29	38	42	281
Johns Hopkins	33	38	33	30	17	23	31	35	32	272
Pennsylvania	24	20	15	25	14	29	18	26	28	199
Cornell	19	7	19	21	23	20	13	21	19	162
Clark	12	5	9	7	1	4	10	18	13	79
Wisconsin	5	6	5	6	11	4	12	9	9	67
Michigan	7	4	5	3	10	10	8	7	8	62
New York	5	9	7	6	4	4	9	7	9	60
Boston	0	0	0	0	0	4	7	14	10	35
California	1	3	2	2	1	3	3	4	9	28
Virginia	0	2	2	8	6	3	1	1	0	23
George Wash.	1	0	5	3	2	4	3	3	2	23
Princeton	0	3	3	3	1	1	2	5	5	23
Minnesota	1	2	3	2	3	3	3	3	2	22
Bryn Mawr	3	3	1	2	2	0	5	2	2	20
Brown.	1	3	3	2	2	5	0	2	1	19
Nebraska	2	1	1	1	0	0	2	3	7	17
Catholic	1	0	0	0	2	2	5	1	5	16
Stanford.	2	0	2	2	2	1	1	1	2	13
Iowa	0	0	0	0	0	2	0	2	5	9
Washington	0	2	0	1	0	1	1	0	2	7
Georgetown.	0	0	0	0	0	3	1	2	0	6
Vanderbilt	0	0	3	1	0	0	0	0	1	5
Colorado	0	1	0	0	0	0	2	0	2	5
North Carolina	0	0	0	0	2	1	0	1	0	4
Illinois	0	0	0	0	0	0	0	1	3	4
Cincinnati	0	0	0	0	0	1	1	1	0	3
Kansas	0	1	0	0	0	2	0	0	0	3
Lafayette	0	0	0	0	0	3	0	0	0	3
Missouri	0	1	0	0	0	0	0	2	0	3
Northwestern	1	1	0	1	0	0	0	0	0	3
Wash. and Lee	0	0	0	0	1	0	1	0	1	3
Lehigh	0	0	0	0	0	2	0	0	0	2
Syracuse	0	1	0	0	1	0	0	0	0	2
Tulane	0	0	1	0	0	0	0	0	0	1
	236	224	239	255	224	270	289	325	325	2387

commissioner of education, states that in 1903 there were 20,887 professors and teachers in the colleges and universities of the United States, not counting professional schools; there were further in the secondary schools 33,795 teachers; or in all considerably more than 50,000 positions. At least one twentieth of these become vacant each year, and the number of new positions is increasing at the rate of more than 2,000 a year. There are probably more than 5,000 academic positions a year which should be filled by the type of men of which the supply appears to be only about 250. Further, these men must fill the large and increasing number of positions in the government service and elsewhere.

There has naturally been no considerable change in the productivity of the different institutions. Chicago and Yale conferred fewer degrees this year than usual, Harvard and Columbia more, and the Johns Hopkins about its average number. These five universities stand very close in their total influence. Harvard is now at the head of the list, surpassing Chicago by one degree, Yale by 8 degrees, Columbia by 23 degrees and the Johns Hopkins by 32 degrees. Several of the state universities have made considerable gains, which are especially noticeable when compared with the earlier years covered by the statistics. Thus this year California conferred 9 degrees; Nebraska, 7; Iowa, 5, and Illinois, 3, or 24 in all, whereas in 1898 these four universities conferred but 3 degrees.

Table II. shows the number of degrees conferred in the sciences enumerated in Table III. From this table it appears that somewhat less than half of all the degrees conferred are in these sciences. The last column of the table gives the percentage of degrees that are conferred in the natural and exact sciences. It thus appears that relatively more graduate work in science is done at Cornell and the Johns Hopkins than at Harvard and Yale.

TABLE II.

DOCTORATES CONFERRED IN THE SCIENCES.

	1898	1899	1900	1901	1902	1903	1904	1905	1906	Total	P. Ct.
Johns Hopkins	19	17	20	19	9	10	17	18	18	147	54
Chicago	12	13	19	16	15	21	14	21	14	145	48
Columbia	10	23	12	13	14	18	11	20	16	137	49
Harvard	11	7	15	15	14	15	23	12	17	129	42
Yale	11	15	10	18	10	13	15	13	15	120	41
Cornell	11	2	11	13	16	13	8	13	7	94	58
Pennsylvania	8	8	6	12	5	14	9	12	11	85	43
Clark	12	5	9	7	1	4	10	18	9	75	95
Michigan	0	3	1	0	5	4	6	?	5	24	39
Wisconsin	2	4	1	3	4	0	4	3	2	23	34
California	1	3	1	2	1	3	2	3	3	19	68
George Wash.	1	0	3	1	1	4	1	3	2	16	69
Brown	1	0	0	1	2	4	0	2	1	11	58
Nebraska	2	1	1	1	0	0	1	2	3	11	65
Bryn Mawr	1	2	1	2	1	0	2	0	1	10	50
Stanford	2	0	0	1	2	1	1	1	2	10	77
Princeton	0	3	1	0	0	1	1	3	0	9	39
Virginia	0	2	0	4	1	2	0	0	0	9	39
Minnesota	0	1	1	0	2	1	0	1	1	7	32
Washington	0	2	0	1	0	1	1	0	2	7	100
Iowa	0	0	0	0	0	1	0	2	3	6	67
New York	1	1	0	1	0	0	1	1	1	6	10
Catholic	0	0	0	0	1	2	1	0	0	4	40
Colorado	0	1	0	0	0	0	0	0	2	3	60
Kansas	0	1	0	0	0	2	0	0	0	3	100
North Carolina	0	0	0	0	2	1	0	0	0	3	75
Vanderbilt	0	0	1	1	0	0	0	0	1	3	60
Wash. and Lee	0	0	0	0	1	0	1	0	1	3	100
Illinois	0	0	0	0	0	0	0	0	2	2	50
Lehigh	0	0	0	0	0	2	0	0	0	2	100
Missouri	0	1	0	0	0	0	0	1	0	2	67
Northwestern	0	1	0	1	0	0	0	0	0	2	67
Cincinnati	0	0	0	0	0	0	0	1	0	1	33
Georgetown	0	0	0	0	0	0	1	0	0	1	17
Lafayette	0	0	0	0	0	1	0	0	0	1	33
Syracuse	0	0	0	0	1	0	0	0	0	1	50
	105	116	113	132	108	138	130	150	139	1131	47

The third table gives the degrees conferred in each of the sciences, whence it appears that last year 38 degrees were given in chemistry, 21 in zoology, 19 in physics, 16 in botany, 12 in psychology, 11 in geology and 9 in mathematics. All the other sciences are responsible for only 13 degrees.

The institutions that conferred three degrees or more in special subjects are as follows: *Johns Hopkins,* chemistry 9, physics 4; *Chicago,* chemistry 4; *Columbia,* botany 4, chemistry 3; *Harvard,* zoology 7, chemistry 3; *Yale,* chemistry 7; *Cornell,* zoology 3; *Pennsylvania,* chemistry 4; *Clark,* psychology 6.

TABLE III.

DOCTORATES CONFERRED IN THE SCIENCES.

	1898	1899	1900	1901	1902	1903	1904	1905	1906	Total
Chemistry	27	32	26	28	27	33	35	36	38	282
Physics	11	7	15	24	12	14	17	14	19	133
Zoology	12	11	11	15	16	12	15	15	21	128
Psychology	18	15	9	13	8	18	10	21	12	124
Botany	11	11	12	8	12	9	17	15	16	111
Mathematics	11	13	11	18	8	7	13	20	9	110
Geology	6	5	5	10	6	10	7	4	11	64
Physiology	4	1	4	1	8	8	1	3	3	33
Astronomy	3	2	4	5	2	4	4	3	4	31
Education	0	5	8	2	1	2	0	6	0	24
Sociology	0	5	3	3	4	2	1	1	0	19
Paleontology	0	4	2	1	0	2	2	3	2	16
Bacteriology	0	1	1	1	1	3	3	0	1	11
Anthropology	2	0	2	1	0	1	2	1	0	9
Agriculture	0	0	0	0	2	2	2	2	0	8
Engineering	0	0	0	1	0	3	1	3	0	8
Mineralogy	0	2	0	0	1	1	0	1	1	6
Anatomy	0	1	0	1	0	4	0	0	0	6
Pathology	0	0	0	0	0	3	0	0	1	4
Metallurgy	0	0	0	0	0	0	0	1	1	2
Geography	0	0	0	0	0	0	0	1	0	1
Meteorology	0	1	0	0	0	0	0	0	0	1
	105	116	113	132	108	138	130	150	139	1131

The names of those on whom the degree was conferred in the natural and exact sciences, with the subjects of their theses, are as follows:

JOHNS HOPKINS UNIVERSITY.

Samuel James Allen: 'The Velocity and Ratio e/m for the Primary and Secondary β Rays of Radium.'

Roger Frederic Brunel: 'A Study of the Salts of Tautomeric Compounds. Reactions of Urazole Salts with Alkyl Halides.'

Robert Ervin Coker: 'Diversity in the Scutes and Bony Plates of *Chelonia*.'

Thomas Sidney Elston: 'The Fluorescent and Absorption Spectra of Anthracene and Phenanthrene Vapors.'

Howard Edwin Enders: 'A Study of the Life History and Habits of *Chætopterus Variopedatus*.'

Charles Walter Gray: 'An Electrical Method for the Simultaneous Determination of Hydrogen, Carbon and Sulphur in Organic Compounds.'

Charles Clayton Grove: I., 'The Syzygetic Pencil of Cubics and a New Geometrical Development of its Hesse Group G_{216}.' II., 'On the Complete Pappus Hexagon.'

Ernest Jenkins Hoffman: I., 'Osmotic Pressure of Cane-sugar Solutions.' II., 'The Semi-permeable Membrane of Copper Cobalticyanide.'

B. Smith Hopkins: 'The Osmotic Pressure of Glucose Solutions, and the Freezing-point Depressions and Densities of Solutions of Glucose and Cane Sugar; also Some Experiments on the Osmotic Pressure of Urea Solutions.'

Edward Pechin Hyde: 'Talbot's Law as applied to the Rotating Sectored Disk.'

William Lee Kennon: I., 'Osmotic Pressure of Solutions of Cane Sugar.' II. 'A Study of Zinc Ferrocyanide as a Semi-permeable Membrane for the Measurement of Osmotic Pressure.'

LeRoy McMaster: 'The Conductivity and Viscosity of Solutions of Certain Salts in Water, Methyl Alcohol, Ethyl Alcohol, Acetone and Binary Mixtures of these Solvents.'

John Frederick Messick: 'Cubic Curves in Reciprocal Triangular Situation.'

August Herman Pfund: 'Polarization and Selective Reflection in the Infra-red Spectrum.'

William Frederick Prouty: 'The Niagara and Clinton Formations of Maryland.'

Charles Judson Robinson: I., 'A Continuation of the Study of the Action of Amines on Camphoroxalic Acid.' II., 'The Combustion of Halogen Compounds in the Presence of Copper Oxide.' III., 'Some Experiments relating to the so-called Infusible Diamide of Parasulphaminebenzoic Acid.'

Charles August Rouiller: 'The Relative Migration Velocities of the Ions of Silver Nitrate in Water, Methyl Alcohol, Ethyl Alcohol and Acetone, and in Binary Mixtures of these Solvents, together with the Conductivity of such Solutions.'

William Anderson Syme: 'Some Constituents of the Poison Ivy Plant (*Rhus Toxicodendron*).'

HARVARD UNIVERSITY.

Henry Bryant Bigelow: 'Studies on the Nuclear Cycle of *Gonionemus murbachii* Mayer.'

Leon Jacob Cole: 'An Experimental Study of the Image-forming Powers of Various Types of Eyes.'

Harvey Nathaniel Davis: I., 'A PQ Plane for Thermodynamic Cyclic Analysis.' II., 'The Longitudinal Vibrations of a Rubbed String.'

James Walter Goldthwait: 'The Abandoned Shore Lines of Eastern Wisconsin.'

Murray Arnold Hines: 'A Revision of the Atomic Weight of Manganese.'

Arthur Day Howard: 'The Visual Cells in Vertebrates, chiefly in *Necturus Maculosus*.'

Burritt Samuel Lacy: 'Temperature Coefficients of Concentration Cells and of Electrodes, and the Thomson Effect in Electrolytes.'

George Richard Lyman: 'Culture Studies of Hymenomycetes.'

John Hancock McClellan: 'The Development of the Excretory System of *Amia calva*.'

Hansford MacCurdy: 'The Influence of Selection on Color Pattern in Guinea Pigs and Rats.'

Robert Dawson MacLaurin: 'Derivatives of Substituted Orthobenzoquinones.'

George Rogers Mansfield: 'The Origin and Structure of the Roxbury Conglomerate.'

Samuel Ottmar Mast: 'Light Reactions in Lower Organisms: I. *Stentor Cœruleus*.'

Lincoln Ware Riddle: 'Contributions to the Cytology of the Entomophthoraceæ.'

William Henry Roever: 'Brilliant Points.'

Alpheus Wilson Smith: 'Expansion and Compressibility of Ether and of Alcohol in the Neighborhoods of their Boiling Points.'

Herbert Eugene Walter: 'The Reactions of Planarians to Light.'

COLUMBIA UNIVERSITY.

Howard J. Banker: 'A Contribution to a Revision of the North American Hydnaceæ.'

Frederic Columbus Blake: 'The Reflection and Refraction of Electrical Waves by Screens of Resonators and by Grids.'

Ira Detrich Cardiff: 'A Study of Synapsis and Reduction.'

Frederick Van Dyke Cruser: 'The Insoluble Chromicyanides.'

Henry Allan Gleason: 'A Revision of the North American Vernonieæ.'

Louis Hussakof: 'Studies on the Anthrodira.'

Clarence Whitney Kanolt: 'The Combination of a Solvent with the Ions.'

Raymond Carroll Osburn: 'The Origin of Vertebrate Limbs. Recent Evidence upon this Problem from Studies on Primitive Sharks.'

Fred James Pack: 'The Geology of Pioche, Nev., and Vicinity.'

Thomas Thornton Read: 'The Amalgamation of Gold Ores.'

Charles Budd Robinson: 'The Chareæ of North America.'

Harvey Ambrose Seil: 'Further Investigations in the Quinazoline Group.'

John Fairfield Thompson: 'Platinum Silver Alloys.'

Frederic Lyman Wells: 'Linguistic Lapses, with especial reference to the Perception of Linguistic Sounds.'

Samuel Robinson Williams: 'On the Reflection of Cathode Rays from Thin Metallic Films.'

John Howard Wilson: 'Glacial History of Nantucket and Cape Cod, with an Argument for a Fourth Center of Glacial Dispersion in North America.'

YALE UNIVERSITY.

Raymond Harman Ashley: 'The Oxidation of Sulphur Dioxide in Analysis.'

Kate Grace Barber: 'Comparative Histology of Fruits and Seeds of Certain Species of Cucurbitaceæ.'

Edward Herbert Cameron: 'Voluntary Production of Tones under Varying Conditions of Attention.'

Haroutune Mugurdich Dadourian: 'On the Radioactivity of Underground Air and on Some Radioactive Properties of Thorium.'

Robert Banks Gibson: 'On Proteose Fever: an Experimental Study.'

Albert Hileman: 'The Determination of Fluorine eliminated as Silicon Fluoride.'

Carl Oscar Johns: 'Researches in Organic Chemistry.'

Ellis Earle Lawton: 'Wave-lengths and Structural Relation of Certain Bands in the Spectrum of Nitrogen.'

Gerald Francis Loughlin: 'Contribution to the Geology of Eastern Connecticut.'

Elmer Verner McCollum: 'Researches in Organic Chemistry.'

George Albert Menge: 'Researches in Organic and Physical Chemistry.'

Seth Enoch Moody: 'The Hydrolysis of Certain Dissolved Salts in Presence of Iodides and Iodates.'

Roland George Dwight Richardson: 'Improper Multiple Integrals.'

Clifton James Sarle: 'The Medina Formation and Fauna of New York.'

Gustaf Eric Wahlin: 'The Relation between the Binary Quadratic Forms and the Quadratic Numerical Bodies.'

UNIVERSITY OF CHICAGO.

James Francis Abbott: 'The Morphology of Cœloplana.'

Russell Burton-Opitz: 'The Periodic and Irregular Variations in the Venous Blood-flow.'

Harvey Carr: 'Some Visual Illusions due to Eye Closure.'

David John Davis: 'The Bacteriology of Whooping Cough.'

William Lloyd Evans: 'The Action of Alkalies and Oxidizing Agents on Benzoyl Carbinol.'

Henry Max Goettsch: 'The Affinity Constants of Diacid Bases.'

Frank Loxley Griffin: 'Certain Periodic Orbits

of *K* Finite Bodies revolving about a Relatively Large Central Mass.'

Glenn Moody Hobbs: 'The Relation between *P.D.* and Sparking Distance for Small Values of the Latter.'

William Raymond Longley: 'A Class of Periodic Orbits of an Infinitesimal Body subject to the Attraction of *N* Finite Bodies.'

Carleton John Lynde: 'The Effect of Pressure on Surface Tension.'

William McCracken: 'On the Hydrochlorides of Imido-ether Derivatives.'

Stephen Walter Ranson: 'Retrograde Degeneration in the Spinal Nerves.'

Hermann Irving Schlesinger: 'Velocity Determinations with Imido-ethers.'

Delonza Tate Wilson: 'Work on Minor Planets.'

UNIVERSITY OF PENNSYLVANIA.

Samuel Goodwin Barton: 'Secular Perturbations arising from the Action of Saturn on Mars, an Application of the Method of Louis Arndt.'

Benjamin Franklin Finkel: 'Determination of all Groups of Order 2 which contain Cyclic Self-conjugate Sub-groups of Order 2 and whose Generating Operations correspond to the Partitions.'

Anna Lockhart Flanigen: 'The Electrolytic Determination of Copper in an Alkaline Cyanide Electrolyte.'

Benno Humbert Alfred Groth: 'The Sweet Potato, Origin and History, Economic Value, Structure and Classification of Varieties.'

Joel Henry Hildebrand: 'The Determination of Anions in the Electrolytic Way.'

Edith Dabele Kast: 'The Mean Right Ascensions and Proper Motions of 130 Stars.'

Louis Krautter, Jr.: 'The Genus Pentstemon.'

Julia Langness: 'A New Form of Anode in Electro-analysis and the Rapid Electrolytic Determination of Certain Platinum Metals.'

Jesse Francis McClendon: 'On the Development of Parasitic Copepoda.'

Charles Travis: 'Pyrite from Cornwall, Lebanon County, Pennsylvania.'

Luther Ferree Zerr Witmer: 'The Electrolytic Determination of Tin and its Separation from Antimony with a Rotating Anode.'

CLARK UNIVERSITY.

Frank Kelton Bailey: 'On the Latent Heat of Recalescence in Iron and Steel.'

William Frederick Book: 'The Acquisition of Skill in Typewriting.'

Alvin Borgquist: 'Crying.'

Alfred A. Cleveland: 'The Psychology of Chess and of Learning to Play it.'

Frederick N. Duncan: 'A Comparative Study of Contractile Tissue.'

Arnold Lucius Gesell: 'Jealousy.'

George Edmund Myers: 'A Comparative Study of Moral Training.'

James P. Porter: 'The Habits, Instincts and Mental Powers of Spiders, Genera *Argiope* and *Epeira*.'

James Theron Rood: 'Quantitative Investigations on the Transmission of Sound by the Telephone.'

CORNELL UNIVERSITY.

Cornelius Betten: 'The Wing Venation of Trichoptera.'

Elmer Clifford Colpitts: 'On the Twisted Quintic Curves.'

Samuel Perkins Hayes: 'A Study of the Affective Qualities.'

Thomas J. Headlee: 'Phylogeny of the Butterflies as shown by their Wing Venation.'

Martin Joshua Iorns: 'Influence of Acetylene Light on Plant Growth.'

Helen Isham: 'A Contribution to the Chemistry of Hydronitric Acid.'

Charles Herschel Sisam: 'Ruled Surfaces of Order Seven having a Rectilinear Directrix.'

UNIVERSITY OF MICHIGAN.

Alfred Dachnowski: 'Beitrag zur Kenntnis der Entwicklungs-Physiologie von Marchantia polymorpha, L.'

William D. Henderson: 'The Thermo-electric Behavior of Silver in a Thermo-element of the First Class.'

Rufus Percival Hibbard: 'Influence of Tension on the Formation of Mechanical Tissue in Plants.'

Alexander Grant Ruthven: 'Genetic Relationships among the Garter Snakes.'

John Frederick Shepard: 'Organic Changes and Feeling.'

UNIVERSITY OF CALIFORNIA.

Sebastian Albrecht: I., 'A Spectrographic Study of the Fourth Class Variable Stars Y Ophiuchi and T. Vulpeculæ.' II., 'On the Distortions of Photographic Films on Glass.'

Nathaniel Lyon Gardner: 'Cytological Studies in Cyanophyceæ.'

Charles David Snyder: 'The Influence of Temperature upon the Heart Rhythm in the Light of the Law of Chemical Reaction Velocity as influenced by Temperature.'

STATE UNIVERSITY OF IOWA.

Rudolph Martin Anderson: 'The Birds of Iowa.'

Charles Howard Edmonson: 'The Protozoa of Iowa.'

Daniel Starch: 'Perimetry of the Location of Sound.'

UNIVERSITY OF NEBRASKA.

Charles Newton Gould: 'The Geology and Water Resources of Oklahoma.'

Jesse Perry Rowe: 'Montana Coal and Lignite Deposits.'

Robert Thompson Young: 'Development of *Cysticercus*.'

UNIVERSITY OF COLORADO.

Heman Burr Leonard: 'On the Factoring of Composite Algebras.'

James Underhill: 'Areal Geology of Lower Clear Creek.'

GEORGE WASHINGTON UNIVERSITY.

Cornelius Lott Shear: 'Cranberry Diseases.'

Martin Norris Straughn: 'The Chemistry of Different Varieties and Individual Ears of Sweet Corn as affected by Enzymes, Climatic Conditions and Breeding.'

UNIVERSITY OF ILLINOIS.

Melville Amasa Scovell: 'The Salicylic Modification for determining Nitrogen by the Kjeldahl Method.'

Perry Fox Trowbridge: 'Proteids of Flesh.'

LELAND STANFORD JUNIOR UNIVERSITY.

John Merton Aldrich: 'A Catalogue of North American Diptera.'

Walter Kenrick Fisher: Part I., 'Anatomy of *Lattia gigantea* Gray.' Part II., 'Starfishes of the Hawaiian Islands.' Part III., 'Holothurians of the Hawaiian Islands.' Part IV., 'Starfishes of California.' Part V., 'Starfishes collected by the Steamer *Albatross* in Alaska, in 1903.'

WASHINGTON UNIVERSITY.

George Grant Hedgcock: 'Studies upon Some Chromogene Fungi which discolor Wood.'

Perley Spaulding: 'Studies on the Lignin and Cellulose of Wood.'

UNIVERSITY OF WISCONSIN.

Irving Walter Brandel: 'Plant Pigments.'

John Langley Sammis: 'On the Relation between Electrolytic Conductivity and Chemical Activity.'

BROWN UNIVERSITY.

Vahan Simon Babasinian: 'A Study of the Methods of Preparation and the Properties of α-Phenyl-Naphthalene-Dinitro-Dicarboxylic Anhydride.'

BRYN MAWR COLLEGE.

Frances Lowater: 'The Spectra of Sulphur Dioxide.'

UNIVERSITY OF MINNESOTA.

John Zeleny: 'The Velocity of the Ions produced by Röntgen Rays.'

NEW YORK UNIVERSITY.

Maximilian Philip: 'Form and Movements of Liquid Jets.'

VANDERBILT UNIVERSITY.

Griffith Thompson Pugh: 'The Pleistocene of South Carolina.'

WASHINGTON AND LEE UNIVERSITY.

A. F. White: 'Composition of the Waters of Rockbridge County, Virginia, and their relation to the Geological Formations.'

SCIENTIFIC BOOKS.

Gesammelte Werke. By ADOLF VON BAEYER. Vol. I., pp. 1–990, with an introduction, pp. i–cxxxii; Vol. II., pp. 1–1194. Braunschweig, Vieweg and Sohn. 1905.

The friends and students of Adolf von Baeyer deemed his seventieth birthday a fitting occasion for honoring him by the publication of his scientific papers, 278 in number, from 1857 to 1905; and Baeyer graciously gave his consent to the plan. In the introduction, pp. i–xx and xxviii–xxxi, the great chemist gives a brief and very interesting account of the chief events in his life; he then discusses, on pp. xxxi–xxxvii, the main trend and bearing of his scientific work.

Emil Fischer gives, on pp. xxi–xxvii, a striking sketch of the life in the laboratory of Baeyer at Strassburg.

"Es wurde nicht schulmässig unterrichtet sondern kameradschaftlich gearbeitet."

There is also a list, pp. lvi–cxviii, of all the scientific papers published from Baeyer's laboratories, Berlin, 1860–72; Strassburg, 1872–5, and Munich, 1875–1905.

It is hardly possible for any one who has

not had the privilege of being a student in his laboratory to realize the tremendous enthusiasm, energy and resourcefulness with which Baeyer has devoted himself to chemistry during the past forty-eight years. One of his great ambitions was to found a school of chemists; that he has succeeded remarkably in this respect is shown by the fact that for years he has held a position in the chemical world similar to that formerly possessed by Berzelius and by Liebig. In the official address of the German Chemical Society, presented in connection with the seventieth birthday festivities, it is admitted that no one since Berzelius and Liebig has exerted such an influence on chemical teaching and research as Baeyer—and yet Baeyer has written no textbook on chemistry, has made no claims as a pedagogue, and has not added to the science a new law or generalization.

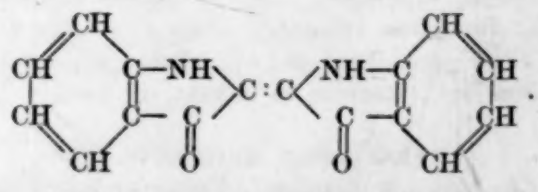
The fact that theories have had so slight an influence on his work—possibly because he realized to the fullest extent their inadequacy and temporary character, but especially because he did not need them in order to make scientific discoveries—deserves special emphasis. He possesses to a remarkable degree the rarest of scientific gifts, namely, the power to ascertain facts accurately regardless of theories—a power which is only to be found in those possessing experimental skill of the highest order. In this respect he is the direct antipode of Kekulé, who was especially interested in developing new views and was not interested in substances as such, and who at times gave one the impression of wishing to adjust nature in harmony with his own theories. In the words of Baeyer, his first student, 'Kekulé war der geborne chemische General, er wollte die Natur commandieren.'

Baeyer, on the other hand, having no special views to present or to defend, approached nature from a totally different standpoint; 'meine Versuche habe ich nicht angestellt um zu sehen ob ich recht hatte sondern um zu sehen wie die Körper sich verhalten.' In other words, he let nature or the facts teach him and then adjusted himself accordingly. One who knows Baeyer, either through personal contact or by means of a thorough and laborious study of his scientific publications, finds in him a love and respect for truth for its own sake which is both rare and admirable. This characteristic, taken in connection with the unusual experimental power shown in his work, explains the marked influence he has exerted on the development of the chemistry of carbon compounds. It is impossible to give here more than a brief statement of the direction of Baeyer's work which deals entirely with the chemistry of carbon.

Regardless of what the future may have in store for us concerning the disintegration of matter, it is certain that the chemistry of the element carbon must always remain of paramount interest because its development is absolutely essential to a fundamental knowledge of the chemical processes going on in the vegetable and animal kingdom and must lead ultimately to a scientifically exact biology and medicine.

Baeyer himself makes nineteen subdivisions in his work from 1857 to 1905; in many cases he was engaged for over a decade on a single subdivision and in most cases he was a pioneer in the field.

His work on indigo, from 1866–70 and from 1877–84, is of general interest because we have here one of the first instances in which a complex plant product was made by synthesis in the laboratory. The synthesis was preceded by years of labor which finally resulted in determining that the 'architecture' of the indigo molecule could be represented by the graphical formula



As the direct outcome of this work, indigo has been manufactured commercially since 1891 from anthranilic acid. Similarly another complex dyestuff, alizarine, has been made commercially since 1875 from coal-tar products, instead of from the madder root, owing to the work of Graebe and Liebermann in Baeyer's laboratory in 1868.

The 'architectural' method is in fact the only method by which we can reasonably hope to make progress in the synthesis of the various complex products found in nature; experience has shown that when the architecture of a definite chemical compound, no matter how complex, has once been thoroughly worked out, it is then often a comparatively simple matter to accomplish its synthesis—whereas the preliminary work may require decades of time.

The plant, which is the great synthetic agent in nature, manufactures at ordinary temperatures under comparatively simple conditions from the carbon dioxide of the air and from the material found in the soil—water, phosphates, nitrates, potassium and ammonium salts, etc.—a vast variety of complex carbon compounds which subsequently undergo various chemical changes in the animal world. There is abundant justification for the conclusion that when the conditions under which these various chemical processes take place are better understood we may reasonably hope to accomplish all these transformations in the laboratory. Much of the faithful and laborious work carried on by investigators in the field of carbon chemistry during the past seventy or more years must in fact be considered preliminary to the accomplishment of this great end.

Baeyer has always shown an unusually great interest in this direction; his indigo work, all his condensation work with aldehydes, alcohols, phthalic anhydride and various benzene derivatives, as well as his synthetic work in the pyrrol, indol, pyridine and quinoline series—all were undertaken with this end in view. He has emphasized the important rôle which formaldehyde must play in the conversion of the carbon dioxide of the air by plants into sugar and starch and has also in this connection discussed theoretically, in 1870, the chemistry of fermentation.

His very important work on the constitution of benzene from 1866–73 and from 1885–94, although fruitless in the main point at issue, led to a thorough and systematical development of the chemistry of di-, tetra- and hexahydro-benzene compounds; this work naturally led him into the field of terpentine chemistry, on which he has spent eight years, from 1893–1901, working out the 'architecture' of many of these important vegetable products as well as synthesizing some of the simplest representatives of the series.

His most recent work has dealt with peroxides, with dibenzalacetone and triphenylmethane and with the basic properties of oxygen. The fact that all carbon compounds containing oxygen, except the peroxides, are capable of forming oxonium salts, containing quadrivalent oxygen, was established by Baeyer on the basis of Collie and Tickle's work on dimethylpyrone; this discovery has excited very general interest.

J. U. NEF.

SOCIETIES AND ACADEMIES.

THE IOWA ACADEMY OF SCIENCE.

THE twentieth annual meeting of the Iowa Academy of Science was held on April 20–21, 1906, in the botanical rooms of the Iowa State College, Ames, Ia. The magnificent new Central Hall was placed at the disposal of the academy. The meetings were all held in the botanical rooms with the exception of the Friday afternoon meeting, which was held in the physics lecture room of Engineering Hall.

Friday afternoon Dr. Hermann von Schrenk, of the U. S. Department of Agriculture, gave an address on the work of the 'Division of Pathology.' On Friday evening Professor Charles R. Barnes, of the University of Chicago, gave an illustrated lecture on 'How Plants breathe.' On Saturday forenoon Professor Charles E. Bessey, of the University of Nebraska, formerly of Iowa State College, gave an address on 'The Forest Trees of Eastern Nebraska.' The meeting of 1906 was probably the most enjoyable in the history of the academy.

The officers for the coming year are:

President—Professor C. O. Bates, of Coe College, Cedar Rapids.

First Vice-president—Professor G. E. Finch, Marion.

Second Vice-president—Professor A. A. Bennett, Iowa State College, Ames.

Treasurer—Professor H. E. Summers, of Iowa State College, Ames.

Secretary—Professor L. S. Ross, of Drake University, Des Moines.

The meeting in 1907 will be held at Drake University.

The following program was presented:

M. F. Arey: 'A Review of the Development of Mineralogy.'

H. W. Norris: 'The Carotid Arteries and their Relation to the Circle of Willis in the Cat.'

N. Knight: 'A Study of Dolomite and Magnesite with special reference to the Separation of Calcium and Magnesium.'

Bruce Fink: 'Ecological Notes from an Illinois Esker.'

J. Fred Clark: 'The Disparity between Age and Development in the Human Family.' (Illustrated by pronounced cases due to thyroid malformations.)

L. H. Pammel: 'Some Diseases of Rocky Mountain Plants.'

John L. Tilton: 'An Attempt to illustrate Tides and Tidal Action.'

J. E. Todd: (*a*) 'More Light on the Origin of the Missouri River Loess,' (*b*) 'Some Variant Conclusions in Iowa Geology.'

W. S. Hendrixson: (*a*) 'The Action of Bromic Acid on Metals,' (*b*) 'Logarithmic Factors for Use in Water Analysis,' (*c*) 'A List of Chemical Periodicals in Iowa.'

T. J. Fitzpatrick: 'The Liliaceæ of Iowa.'

L. Begeman: 'Mutual Induction and Internal Resistance of a Battery.'

Bruce Fink: 'Lichens and Recent Conceptions of Species.'

T. E. Savage: 'Some Unusual Features of the Maquoketa Shale in Jackson County, Iowa.'

A. T. Erwin: '*Amelanchier alnifolia* and its Cultivated Forms.'

Paul Bartsch: 'The Iowa Ornithological Literature of the Nineteenth Century.'

Walter J. Meek: 'A Study of the Choroid Plexus.'

Frank F. Almy: (*a*) 'The Effect of Pressure on Lines in the Spectrum of Iron,' (*b*) 'A Simple Demonstration of the Doppler Effect in Sound,' (*c*) 'The Physical Laboratory of Iowa College.'

G. E. Finch: 'A Portion of the Iowan Drift Border in Fayette County, Iowa.'

B. A. Place: 'The Relation of the Motor Nerve Endings to Voluntary Muscle in Amphibia.'

Fred J. Seaver: 'Notes on the Discomycete Flora of Iowa.'

Charles R. Keyes: (*a*) 'Lime Creek Fauna of Iowa in Southwestern United States and Northern Mexican Region.' (*b*) 'Geology of the Corinth Canal Zone.' (*c*) 'Alternation of Fossil Faunas.'

J. E. Guthrie: 'The Collembolan Eye.'

J. M. Lindly: 'Flowering Plants of Calcasieu Parish, Louisiana.'

F. A. Brown: 'Some Contributions to Madison County Geology.'

O. M. Oleson and M. P. Somes: 'Flora of Webster County, Iowa.'

K. E. Guthe: 'Electrical Units.'

H. P. Baker: 'The Holding and Reclamation of Sand Dunes by Tree Planting.'

L. S. Ross: (*a*) 'The Food of Subterranean Crustacea,' (*b*) 'Number of Bacteria in Des Moines School Buildings.'

B. O. Gammon: 'Cladocera in the Vicinity of Des Moines.' Presented by L. S. Ross.

D. W. Morehouse: 'Photographic Accessories of Drake University Equatorial.' Introduced by L. S. Ross.

C. O. Bates: 'Municipal Hygiene—Part II., Milk.'

B. Shimek: (*a*) 'Notes on Certain Iowa Trees and Shrubs,' (*b*) 'The Loess of the Missouri Bluffs.'

J. A. Udden: 'Cyclonic Distribution of Precipitation.'

L. S. Ross,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE MUTATION THEORY AGAIN.

Certain objections to the mutation theory of de Vries have called forth the wrath of Professor C. S. Gager, and he emphatically demands that this theory should be thoroughly understood before we discuss it.[1] With more zeal than discretion he affirms that this lack of understanding is shown in two recent articles published in Science, one of which has the present writer for its author;[2] he calls these articles a display of mental density, claiming that the views of de Vries have been misrepresented; but with reference to my own paper he only succeeds in demonstrating that he in turn has entirely failed to grasp the

[1] De Vries and his critics, in Science, July 20, 1906, p. 81 ff.

[2] Science, May 11, 1906, p. 746 ff.

essence of my views, and further, that other publications of mine on this and kindred subjects, which are absolutely necessary for the proper understanding of my views, are unknown to him.

The chief purpose of my article was to object to de Vries's conception of mutation and elementary species. If I object to these terms, of course, I do not accept them, and since I have given reasons for believing that they are wrong, the only appropriate rejoinder to this would be to show that my reasons are no good. Instead of this, Gager is satisfied with the vague and superficial statement that it is impossible to satisfactorily define the concept of species, neglecting entirely what I have written on this topic previously,[3] and, further, he spills a good deal of ink in reiterating de Vries's contentions.

Gager says:[4] "*When a careful worker says that he obtained a given form that breeds absolutely true, and which, for reasons fully explained, he calls an 'elementary species,' by means of a certain definite and clearly explained kind of variation which he defines and names 'mutation,' let us not refer to him as 'claiming to' have done so, or to the mutant as 'seeming to' breed true.*"

Here we have a concise statement of de Vries's claim, namely, that *he obtained a form that breeds true by means of mutation.* I have said[5] that de Vries claims *'that mutants are species.'* But if de Vries calls a form that breeds true an elementary species, *he obtained species by means of mutation;* and if the product of the process of mutation is a mutant, of course, *a mutant is obtained by means of mutation,* and, consequently, *mutants are (elementary) species.* Thus it is evident that my expression of de Vries's claim is *absolutely correct* and identical in its meaning with that given by Gager, *and his allegation that I have misunderstood de Vries is entirely unwarranted.* It rather seems that Gager himself has not fully understood what de Vries says, at any rate, that he was not aware of the true meaning and import of de Vries's theory. This is due, in part, to the fact that de Vries himself was not conscious of the logical consequences of his views, he belonging to the class of writers who are oblivious of the most fundamental principles of evolution.[6]

However, as I have endeavored to show, *I do not accept* the view that *mutants are species,* or *that de Vries obtained a form that breeds true by means of mutation.* In opposition to this I say, *that he obtained such a form by means of selection and segregation out of a certain kind of variation (mutation).* Indeed, Gager endorses also the latter view[7] by an emphatical 'Exactly!' and asks: 'why the dissenting critique?'

This plainly shows that, for Gager, these two phrases are identical, namely, that de Vries *obtained species by means of mutations,* and that he *obtained them by means of selection and segregation out of mutations.* Possibly my mental density comes in here; but I can not help it; I must regard these two phrases as having a *different* meaning, and this is the reason for my 'dissenting critique'; de Vries *never* said anything that might be interpreted in the sense of the second sentence.

That de Vries's view is wrong I have demonstrated by pointing out that the mutants actually did not breed true before he started his experiments, and very likely they would not have bred true if he had not taken them under his care. They began to breed true, not because they were mutants, formed by the process of mutation, but because he introduced two factors, which were absent previously, namely, selection and segregation. 'Pedigree-culture is the method required,' as Gager[8] quite correctly insists, but apparently without knowing of what it consists. The essential factors in pedigree-culture are selection and segregation, and pure strains are only ob-

[3] *Pr. Amer. Philos. Soc.*, 35, 1896.

[4] *L. c.*, p. 89.

[5] *L. c.*, p. 746.

[6] See Ortmann, SCIENCE, June 22, 1906, p. 947 ff.

[7] *L. c.*, p. 87, in the form: *'If de Vries had claimed that species might be made out of mutations'* (Ortmann, p. 747), namely, as is said in the same paragraph, but carefully omitted by Gager, *by means of selection and segregation.*

[8] *L. c.*, p. 86.

tained after a number of generations, as is seen in de Vries's experiments.

This is so evident, that it is simply astonishing that Gager is not capable of seeing it, even after attention has been called to it, and that he does not see that this is an important part of my objections, namely, *that it is selection and segregation that make mutants breed true.* Indeed, he asks:[9] "Where, from cover to cover, of 'Species and Varieties,' is any other claim made?" Please look at the title: 'Species and Varieties, their Origin by Mutation'; is this identical with 'Species and Varieties, their Origin by Selection and Segregation'? In my opinion, the *first* phrase means that by the process of mutation species (elementary species, which breed true) are made; the *second,* that selection and separation make them breed true. The *first* means that the quality of breeding true was created by the mutation process, before de Vries made the experiments, and (as de Vries says in the text) that the latter were undertaken only in order to *test,* to ascertain the existence of this quality; while the *second* means that the quality of true breeding was created, not by the process of mutation, but by the subsequent processes of selection and segregation. If Gager can not see the difference, I am sorry for him; or should it again be a case of mental density on my part?

If we remove this fundamental fallacy out of de Vries's theory, that it is not the process of mutation, but that of selection and segregation, which makes species breed true, nothing remains but the view that mutation is a peculiar kind of variation, which alone may start the species-making process, or which alone is apt to finally produce true breeding forms. A part of my article is written with reference to this possible claim, although I know very well that de Vries did not make it separately,[10] but always in connection with the first claim, that it is the process of mutation which produces true-breeding, elementary species.

[9] *L. c.*, p. 87.

[10] That I did not intend to represent this as de Vries's view, but only as a possible modification of it, is clearly seen in SCIENCE, June 22, 1906, p. 950, foot-note 9.

Gager[11] quotes my sentence,[12] but omits the introductory and important words: 'aside from the above claim.' This, of course, affords him a chance to show that I have misunderstood de Vries. But if we exclude the only test for the elementary species, that they should be true-breeding forms, as unsatisfactory, no other difference remains between fluctuating variation and mutation, but the degree or amount of deviation from the original type, the one being represented by 'small steps,' the other by 'sudden leaps'; and I must repeat that I am unable to draw a line between them. If Gager[13] again points to de Vries's definition of mutation (that it causes true breeding), I hardly can call this a fair criticism or a fair understanding of my views, after I have expressly excluded this criterion.

In this last instance, and in a few others, Gager directly distorts what I am saying. I have said[14] that 'in the beginning of the experiments, they (the mutations or mutants) were throwing off additional mutants.' Gager[15] omits the words 'in the beginning of the experiments,' and quotes the sentence as if it was clearly implied that I meant to say that '*all* the mutants were throwing off additional mutants.' In fact, I did not mean to say 'all,' for this would not correspond to the facts; and the words 'in the beginning of the experiments' are essential for the proper understanding of the whole paragraph, and of my contention that the mutants did not breed true, namely, *in the beginning:* they bred true *later on, in consequence of the experiment,* which was the point I wanted to bring out.

Further, when I say[16] that 'the breeding of domestic races has *always* been regarded as a process analogous to the one in nature by which new species are produced,' 'always' does not mean: by everybody and at all times. If it is hinted at by Gager[17] that I possibly might have intended to include Linnaeus or

[11] *L. c.*, p. 87.

[12] *L. c.*, p. 747.

[13] *L. c.*, p. 88.

[14] *L. c.*, p. 747.

[15] *L. c.*, p. 86.

[16] *L. c.*, p. 747.

[17] *L. c.*, p. 87.

other pre-Darwinian writers, this is a display either of mental density or of something worse, for he understood quite well what I meant, as is seen by his own use of the word 'always' further on.[18]

My two main contentions are: *that de Vries's conception of elementary species is inadequate,* and *that elementary species breed true, not because they are the product of a peculiar kind of variation, called mutation, but because they have been subject to the processes of selection and separation.* These essential points in my criticism have been overlooked by Gager, and he is content to say, with regard to the first one, that nobody, except makers of dictionaries, knows what a species is. With regard to my second contention, he fails entirely to see that it is intimately connected with the first one, and has made no attempt to demonstrate that mutation is capable of producing true breeds *without the help of selection and segregation,* and that the latter two factors *do not play an essential part in de Vries's experiments.* For the rest, he only points to de Vries's definitions of terms, which I reject; he points to the facts represented by the experiments, which I accept, but consider unsatisfactory and incomplete; and he points to the value of the experimental method as the only one that is apt to decide questions of evolution, which I positively deny. Experiments are valuable, but they should be properly understood, and should be correctly explained. The interpretation of his experiments given by de Vries is faulty, although the experiments themselves are indisputable facts; and the fallacy is due to his ignorance of the fundamental laws of evolution, and to his incorrect conception of the term species: with the latter his theory stands and falls.[19]

I hope that this will be sufficient, even to Gager, to define my standpoint, and, if any further discussion should be considered necessary, that it will take up the essential points of my views, and not merely repeat the arguments of de Vries. Gager has done only this, in a way which clearly lacks understanding of what I really object to. If he further would consider the rule, not to throw stones at people out of a glass house, and observe the necessary fairness to others, this would make the discussion a more pleasant and profitable one.

A. E. ORTMANN.

CARNEGIE MUSEUM, PITTSBURG,
July 23, 1906.

[18] *L. c.*, p. 88, foot-note 65: 'Since the process has been recognized and described.'

[19] SCIENCE, June 22, 1906, p. 948.

SPECIAL ARTICLES.

HERBARIUM TYPE SPECIMENS IN PLANT MORPHOLOGY.

THE close relationship existing between the different branches of botany and the dependence of these various branches upon each other make it very important that every precaution should be taken by the workers of each branch to make their specialty as helpful as possible to all other divisions of the subject. With the advancement of each phase of the subject the points of relationship become more prominent and the necessity for the preservation of records, specimens, etc., becomes of greater and greater importance.

Between no two branches of botany is the necessity of cooperation greater than between taxonomy and morphology. The taxonomist has long recognized the importance of type specimens and large herbaria have been brought together and maintained at great expense where these types may be preserved and studied to the best advantage. The morphologist has probably in most cases preserved his microscopic specimens, but in how many cases has the morphologist prepared herbarium specimens of the species on which he is working? This custom may and probably is followed by many workers, but it is also true that many morphologists have not only neglected to preserve type material but in many instances have not even taken the precaution to have their determinations verified by specialists in taxonomy.

If morphological botany is to add anything to our knowledge of taxonomic botany, it appears to the writer that herbarium specimens should be carefully prepared, properly labeled,

and deposited in centers of botanical research where they may be consulted by future investigators in both taxonomy and morphology.

Some years since the writer made a morphological study of certain members of the family Nymphæaceæ and among them the northern *Nymphæa advena*. More recently I have made a study of certain tropical species of the same family and among them a species of the genus *Nymphæa*. This species showed such striking resemblances to the well-known species *N. advena*, that it was sent to specialists in taxonomy to verify the determination. The reports from these workers showed a difference of opinion; some claiming that it was a new species, while others claimed that it was a variety. However, the embryology showed certain very marked differences, which may be of sufficient importance to make it a distinct species. Had these two lots of material been studied by different workers, and considered as one species, or by one worker without having the specimens examined by taxonomists, the confusion might have been easily increased rather than diminished.

When we take into consideration the large number of families and genera which are still untouched by the morphologist we must naturally expect that future work will bring to light many new and important facts; and these facts will in turn present certain questions which will make it imperative that certain other species already studied should be restudied in the light of said new facts. It will then be very important that the investigator know positively whether the species in question is the same or merely closely related to the species studied by the first investigator. Johnson,[1] in his studies on Piperales, has recently called attention to the fact that closely related genera may show wide variations in the development of the tapetum, megaspore, embryo-sac and endosperm. From my studies in *Nymphæa* I am inclined to believe that we may also find wider variations between species of the same genera than we have supposed.

Under present conditions two workers in different localities working upon supposedly the same species may honestly present different results or the second may unintentionally and unjustly give expression to criticism on the results of the first worker.

Would it not be well for the plant morphologists at the next meeting of the American Association for the Advancement of Science to consider methods for cooperation and preservation of types.

Mel. T. Cook.
Estacion Central Agronomica,
Santiago de las Vegas, Cuba.

[1] Johnson, Johns Hopkins University Circular No. 178. May, 1905.

THE INTERNATIONAL CATALOGUE OF SCIENTIFIC LITERATURE.

The first meeting of the International Convention of the International Catalogue of Scientific Literature was held in London, July 25–26, 1905. The supreme control of the catalogue is vested in this body and in beginning the undertaking in 1900 it was agreed that its meetings should be held in London in 1905, in 1910 and thereafter every ten years. The following named delegates were present at the convention:

Austria—Professor Dr. August von Bohm, K. K. Hofbibliothek, Vienna.

Belgium—M. Paul Otlet (Secrétaire-General de l'Office International de Bibliographie, Brussels). M. H. La Fontaine (Directeur de l'Office International de Bibliographie, Brussels).

France—Professor G. Darboux (Secrétaire Perpétuel de l'Institut de France). Dr. J. Deniker (Bibliothécaire du Muséum d'Histoire Naturelle, Paris).

Germany—Professor Dr. O. Uhlworm (Director des Deutschen Regionalbureau).

Greece—His Excellency Mons D. Métaxas (Ministre Plénipotentaire de S. M. le Roi des Hellènes).

Holland—Professor D. J. Korteweg (University of Amsterdam).

India—Lieutenant-Colonel Prain, I.M.S., F.R.S.

Italy—Cav. Ernesto Mancini (Accademia dei Lincei, Rome). Professor Raffaello Nasini (University of Padua).

Japan—Professor K. Matsubara (University of Tokyo).

Mexico—His Excellency Don Francisco A. de Icaza.

Russia—Professor I. P. Borodin (Imperial Academy of Sciences, St. Petersburg).

South Africa—R. Trimen, Esq., F.R.S.

United Kingdom—Professor H. E. Armstrong, F.R.S. Professor J. Larmor, Secretary Royal Society. Dr. P. Chalmers Mitchell.

Smithsonian Institution—Dr. Leonhard Stejneger (United States National Museum).

Professor H. E. Armstrong having been appointed chairman of the convention, the following resolutions were passed:

On the motion of the chairman, seconded by Dr. Stejneger, it was *Resolved:* That, in view of the success already achieved by the International Catalogue of Scientific Literature and of its great importance to scientific workers, it is imperative to continue the publication of the catalogue at least for a further period of five years.

On the motion of the chairman it was *Resolved:* That the convention approves of the proposal for an amalgamation of the *Zoological Record* published by the Zoological Society of London with Volume N of the International Catalogue in accordance with paragraph 24 of the Report, p. 10, and authorizes the executive committee to carry the proposal into effect.

On the motion of Dr. Stejneger it was *Resolved:* That it is the desire of this convention that the executive committee, as soon as practicable, take into consideration the question of issuing cards.

On the motion of Dr. Stejneger, seconded by Dr. Deniker, it was *Resolved:* That the report of the committee of schedules be adopted.

On the motion of the chairman it was *Resolved:* That the report of the executive committee be adopted and that all matters therein not dealt with by this convention be remitted to the executive committee with power to act thereon.

The report of the executive committee to the international convention covered some twenty-three pages and contained the following statements of interest:

* * * It appears that the date originally contemplated for the completion of the fifth issue (1906) will be exceeded by about six months only. Taking into account the delay which arose in the organization of the work by the regional bureaus, which involved the postponement of the publication of the first annual issue by almost a year, if the result contemplated be achieved, a most satisfactory conclusion of the first stage of the enterprise will have been arrived at in so far as the issue of the printed catalogue is concerned.

REGIONAL BUREAUS.

At the present time Bureaus are established in thirty-two separate regions. The only countries which have not yet established bureaus are Servia and Bulgaria, in Europe, and the South American states. Spain has joined during this year.

Taking into account the character of the enterprise, the successful manner in which the collection of the material has been organized, and the care with which the indexing has been accomplished are little short of remarkable, and reflects the greatest credit on all concerned.

Necessarily there have been very many difficulties connected with a work of such intricacy carried on in various countries by independent organizations; but so great has been the desire to accomplish the work, that these have all been met without the slightest disagreement arising.

It is surprising to what an extent it has been possible for the various bureaus to make use of the schedules provided by the international conference which authorized the enterprise: Obviously in such a case only experience could lead to the establishment of a common system of indexing likely to give general satisfaction.

EXTENSION OF THE ENTERPRISE.

At the meeting of the International Council in May last year, a proposal to extend the scope of the catalogue by the publication of additional series of volumes dealing with such subjects as—(*a*) medicine and surgery, (*b*) agriculture, horticulture and forestry and (*c*) technology (various branches), was discussed and the opinion expressed that it was desirable that the executive committee should take the matter into further consideration in order that it may be brought under notice at the meeting of the convention this year.

After considering this question fully and discussing it with those interested in the work of the catalogue, the executive committee are of opinion that it is undesirable at present to extend the scope of the catalogue. It would be unwise to increase the responsibility of the organization so long as it is not in possession of an adequate working capital. Moreover, it is desirable that the energies of the bureaus should be directed, at all events during the next few years, to perfecting the catalogue in order that it may render all the assistance that was contemplated at its inception to scientific workers in those subjects which, after much discussion, were selected for treatment.

In order to give the work its necessary completeness, the indexing of scientific communications must be carried beyond the mere titles to a far greater extent than has hitherto been the case.

Marked progress in this direction is taking place, but until the cooperation of authors and publishing bodies has been secured it will always be difficult for the bureaus to deal effectively with the literature which they are required to index. The collection of the necessary subject-matter should become automatic in proportion as effective action is taken to secure the proper indexing of papers at the time of issue; at the same time the cost to the regional bureaus should be reduced in a corresponding manner.

At the meeting of the International Association of Academies in London last year, it was resolved to ask the several constituent academies to cooperate in the production of the catalogue in their several countries by securing the indexing of scientific journals at the time of issue. The central bureau is satisfied that it is imperative that the several regional bureaus should in every way exert their influence in order to bring about such cooperation between publishing bodies generally and the International Catalogue of Scientific Literature.

Assuming the catalogue to be established as a permanent enterprise, it can not fail to exercise an influence in various directions on the work of scientific inquiry. The suggestion has already been made to the central bureau that it should be prepared to give information as to the state of knowledge in particular subjects—as is already done, for example, by the authorities of the Bibliographia Zoologica in Zurich. The inclusion on the staff of the central bureau of persons able to collate such information would add much to its efficiency, and it is to be hoped that it may be possible at no distant date.

For such a purpose and in the general interests of scientific workers, it is desirable, moreover, not only that the central bureau should be provided with lists of new species but also that physical constants should be recorded on special slips in order that complete lists of such data may be tabulated.

Another suggestion which has been made to the central bureau is that at the end of ten years a decennial index of each subject should be prepared, which, if not a reproduction of the ten separate volumes, should be at least a key to them.

The present price of each annual issue is fixed at seventeen pounds to contracting bodies. Although it is most important that the price should be reduced, it is not possible, at present, to take any steps in this direction. But it will be desirable to authorize the executive committee to make reductions whenever this becomes possible.

The originators of the catalogue always looked forward to the amalgamation of their enterprise with some of the existing agencies by which scientific literature is indexed, often at a considerable cost and with far more limited opportunities for collecting the necessary material than are now at the disposal of the International Catalogue. The executive committee have, therefore, great pleasure in recommending that during the period 1906–1910 the publication of the zoology catalogue be carried out in conjunction with the Zoological Society of London, by whom, during the past forty years, the well-known index of zoological literature, *The Zoological Record*, has been issued.

The agreement would be that the volumes are issued with a double title page, as volumes of the International Catalogue and as volumes of the *Zoological Record*, in both cases appropriately numbered in continuation with the volumes already issued. The cost of printing and publishing would be charged to the International Catalogue, together with a sum equal to that hitherto expended by the central bureau on special expert assistance. All further costs on account of the revision and arrangement of the material would be borne by the Zoological Society. The International Catalogue would receive the proceeds of all subscriptions and sales. The Zoological Society would appoint a committee of experts to prepare for press the material supplied by the central bureau. The committee of experts would be responsible for the scientific accuracy of the volume, whilst the central bureau would see that the volumes are produced in general accordance with the principles adopted in the catalogue as a whole.

SCHEDULES.

The schedules accepted for use during the first period of five years have been found in practise to answer remarkably well, except in the case of physics, which has proved to be far too narrow in its provisions.

A proposal to issue the zoology volumes in parts has been made. It appears desirable to adopt this proposal; the experience gained in connection with this subject will be of value in determining whether a similar course should be adopted in regard to other volumes.

SCIENTIFIC NOTES AND NEWS.

The British Association for the Advancement of Science will meet next year at Lei-

cester, beginning on July 31. The meeting the following year will be in Dublin, and in 1909 the association will for the third time visit Canada and meet in Winnipeg.

THE University of Leeds has conferred the degree of D.Sc. on the following in connection with the York meeting of the British Association: Professor Ray Lankester, F.R.S., president of the association; Professor Alfred Grandilier, of Paris; Professor Paul Pelseneer, of Ghent; and Professor Heinrich Ruebens, of Berlin. It has further conferred the degree on the following in connection with the meeting of the association and also with the coal-tar color jubilee: Sir W. H. Perkin; Dr. Heinrich Caro, of Mannheim; Professor Albin Haller, of Paris; Professor C. Liebermann, of Berlin, and Dr. C. A. von Martins, of Berlin.

THE London correspondent of the New York *Evening Post* cables: "The sudden compulsory retirement of Ray Lankester from the directorship of the Museum of Natural History on an inadequate pension arouses general condemnation. Mr. Lankester, as testified by his presidency this year over the British Association, has rendered conspicuous services to science. The *Times* says that in any country but this it would be thought grotesque that a distinguished man of science should be treated on the same footing as an ordinary civil service clerk. No explanation has yet been vouchsafed of the cavalier treatment which Mr. Lankester has received."

WE learn from *Nature* that Sir William Crookes, Professor Eduard Suess, Professor Luigi Palazzo and Professor Orazio Marucchi were elected honorary members of the Royal Academy of Acireale (Sicily) at a meeting on July 24.

PROFESSOR CHARLES FLAHAUT, of Montpelier, has been elected an honorary member of the Zoological and Botanical Society of Vienna.

DR. GUSTAV TSCHERMAK, professor of mineralogy and petrography at Vienna, has retired from active service.

MR. GERRIT S. MILLER, JR., assistant curator, division of mammals, U. S. National Museum, has been granted a year's furlough from the museum in order to engage in a biological survey of southwestern Europe. Dr. M. W. Lyon, Jr., has been appointed temporarily assistant curator during Mr. Miller's absence.

DR. ARTHUR HOLLICK, of the New York Botanical Garden, and Professor Edward C. Jeffrey, of Harvard University, have been making studies of the Cretaceous fossil flora of New Jersey and Marthas Vineyard for a joint work on the subject.

DR. FRANK P. WHITMAN, professor of physics at Western Reserve University, will represent the university at the celebration of the University of Aberdeen in September. He attended the York meeting of the British Association.

MR. ALFRED MOSELY will sail for New York on October 10, to assist in making arrangements for the reception of the parties of English teachers that will come to this country during the winter under his auspices. The first party of teachers, numbering about thirty, will sail for the United States on November 30, and thereafter similar parties will sail weekly.

PROFESSOR SAMUEL LEWIS PENFIELD, head of the Department of Mineralogy in the Sheffield Scientific School of Yale University, died at Woodstock, Conn., on August 14, aged fifty years.

MR. GUSTAV WILLIAM LEHMANN, chemist of the U. S. government since 1878 and chief chemist of the Baltimore Board of Health since 1896, died on August 5. Mr. Lehmann was born in Wiesbaden in 1844, and was known for his work on the electrolytic deposition of copper and on the chemistry and bacteriology of food products. He was a fellow of the American Association for the Advancement of Science and a member of the American Chemical Society and the American Institute of Mining Engineers.

DR. WALTER NGON FONG, president of the Li Shing Scientific and Industrial College of Hongkong, died of the plague at Hongkong on May 12 of this year. Dr. Fong was the first Chinese graduate of Stanford University, and was for a time instructor in the University of California. He was one of the ablest

of the Chinese who have been educated in America, and as the head of this new college was exerting a very great influence toward the modernization of Chinese education. He will be remembered as the author of an article on 'Education in China' in the *Popular Science Monthly* in 1905.

Sir John Brunner has given £5,000 towards the completion and equipment of the additional buildings for engineering, metrology and metallurgy now in course of erection at the National Physical Laboratory.

Dr. R. C. Brown, of Preston, Lancashire, has placed at the disposal of the committee for the study of special diseases of the University of Cambridge the sum of £150 per annum for two years, for a pathological scholarship in connection with the investigations now being carried out by the committee on rheumatoid arthritis and allied diseases.

The government steamer *Arctic* has sailed from Quebec for northern latitudes *via* Greenland. She will winter in Lancaster Sound.

The series of stereoscopic cards to accompany the exercises in Titchener's 'Experimental Psychology' has now been published and may be obtained of the Chicago Laboratory Supply Company. Indicative of the interest in this topic as an aid to instruction in psychology is the announcement in the catalogue of Henry Holt and Company of a manual with accompanying photographic illustrations, on 'The Psychology of Stereoscopic Vision.' The author is Professor Jastrow, of the University of Wisconsin.

We learn from the *Geographical Journal* that a schedule has been drawn up by the International Statistical Institute, which is intended to serve as a guide to those who may be in a position to undertake demographical research in uncivilized countries. The principal points on which information is desired are grouped under thirty-five sections, while useful hints are given whereby the inquiry may be carried out to the best advantage. It is suggested that, where possible, enumerations of the population of suitably selected areas may be made, and forms are drawn up for the record of the data on the basis either of the household or the individual. When such inquiries are carried out by individuals, it is asked that the returns be sent to the office of the institute at Rome.

Nature states that the Institute of Chemistry has published a 'List of Official Chemical Appointments held in Great Britain and Ireland, in India and the Colonies.' The list has been compiled under the supervision of the proceedings committee of the institute by Mr. R. B. Pilcher, the secretary of the institute, and its price is 2s. net. The list is arranged in two main divisions: the first contains appointments under the departments of state and professorial appointments in the British Isles; the second section deals similarly with India and the colonies.

The *Electrical World* states that a company has been formed at Berlin having for its object a series of experiments with motor airships. The Emperor's influence directly brought about the movement to make a systematic investigation of air navigation, and, with practically unlimited capital, to experiment with motor airships. Admiral von Hollman was elected president of the company. The directors are Herr Rathenau, Dr. Althoff, director of the Ministry of Public Worship and Instruction; Ernst Borsig, a manufacturer of locomotives; Baron von Brandenstein, Ludwig Delbrueck, Herr Schwabach, of the Bleichroeder Bank, Herr Loewe, of the Mauser Rifle Company, Wilhelm von Siemens, James Simon and N. T. Boettinger. Captain Richard von Kaehler, an engineer of repute, was elected business manager.

We learn from *The Condor* that the Audubon Society of California was formally organized at the Los Angeles Chamber of Commerce on May 31, 1906. This regular state organization will cooperate with the National Committee of Audubon Societies at New York, and also have general supervision over the work of the local societies. An important meeting is planned for the early autumn, when

a definite plan of work will be decided upon. The officers elected at the initial meeting are: *President,* Dr. David Starr Jordan; *Vice-presidents,* Professor C. F. Holder and Dr. F. W. D'Evelyn; *Secretary,* W. Scott Way.

As we have already announced, the British Medical Association will hold its seventy-fourth annual meeting this year in Toronto. From the program, as published in the English journals, we note that thirteen scientific sections have been arranged, and will meet daily in the university buildings at 9:30 A.M., namely, anatomy, dermatology, laryngology and otology, medicine, obstetrics and gynecology, ophthalmology, pediatrics, pathology and bacteriology, physiology, psychology, state medicine, surgery, and therapeutics. On Tuesday, August 21, at 2:30 P.M., an address of welcome will be accorded to members, and the ceremony of introducing the distinguished guests and delegates will be performed. This will be immediately followed by the presidential address by Professor Reeve. At 4:30 P.M., in the university quadrangle, a reception and garden party by the president and Mrs. Reeve. At 8:30 an address in obstetrics will be delivered by Dr. W. S. A. Griffith, of London, while at 9:30 the lieutenant-governor will receive the members of the association. On Wednesday, at 2:30 P.M., an address in medicine will be delivered by Sir James Barr, of Liverpool; and in the afternoon various garden parties have been arranged. In the evening, at 8:30, an address in surgery will be delivered by Sir Victor Horsley, and this will be followed by a reception, at 9:30 P.M. On Thursday afternoon garden parties have also been arranged, while at 7:30 P.M. the president will preside at the annual dinner, when a most distinguished gathering is assured. On Friday afternoon extensive entertainments are promised to members and their friends, while in the evening will be held a grand *soirée.* On Saturday several excursions are arranged—to Niagara Power Company's plant, through the courtesy of Sir Henry M. Pellat; to Muskoka; and to Lambton, through the courtesy of the president, Mr. Austin.

THE London *Times* states that Mr. Sinclair, M.P., secretary for Scotland, received in Edinburg, on July 1, deputations from the Royal Society of Edinburgh and the Royal Scottish Geographical Society. The former urged the claims of science in the readjustment of grants in aid and in the allocation of national buildings contemplated in the National Galleries Bill. In the bill, it was maintained no mention whatever was made of science. The financial clauses of the bill might, and probably would, be limited in their application to art and to existing buildings. No direct provision was made for the representation of science on the new board of trustees, as was recommended by the departmental committee. The new trustees might allocate the whole of the buildings on the Mound to art and evict the Royal Society of Edinburgh. Lord McLaren, vice-president, stated the case on behalf of the society, and was supported by Mr. J. W. Gulland, M.P., Principal Sir William Turner, Principal McKay, Dundee University College; Professor Cash, Aberdeen University; Professor Gray, Glasgow University, and Professor Chrystal, secretary of the society. All pointed to the important place occupied by the Royal Society of Edinburgh as a national institution devoted to scientific research. The secretary for Scotland, in his reply, said he recognized most fully that the work of the Royal Society was a national one. The proposals of the government with regard to the buildings at the Mound were to use the south building as the National Gallery, and in the building next Princes Street, known as the Royal Institution, to house the Royal Scottish Academy. The effect of that rearrangement was that the Royal Society would no longer find accommodation in the Royal Institution buildings; but the government was prepared to meet the reasonable demands of the society in a liberal spirit. He asked them to prepare a scheme for his consideration. He refused to commit himself to an alternative scheme, whereby the Royal Society and other scientific bodies in Edinburgh would combine under one roof, though he was ready to consider any proposal put before him, provided the financial arrangements were reasonable. To the deputation of

the Royal Scottish Geographical Society, who asked for representation on the board of trustees for the National Gallery and a grant from the government, Mr. Sinclair said the bill was wholly concerned with national galleries, and had no reference to scientific bodies. Apart from the question whether government assistance was possible or probable, he stated that government assistance carried with it the disadvantage of government control.

UNIVERSITY AND EDUCATIONAL NEWS.

The will of the late Horace M. Potts bequeathes $5,000 to the Hospital of the University of Pennsylvania for the endowment of a free bed, and $10,000 to the Orphans' Home and Asylum for the Aged Insane of the Lutheran Church. Most of the remainder of his estate, valued at $75,000, is divided between the Philadelphia Academy of Natural Sciences and the University of Pennsylvania.

Mr. Andrew Carnegie has promised $30,000 to Hamline University, St. Paul, Minn., for a library building, on condition that the same amount be raised for its maintenance, which amount is at the present time nearly in hand. The building will probably be begun in the course of the next month or two.

Suit has been instituted in the Supreme Court of the District of Columbia to compel the Catholic University of America to relinquish securities aggregating $876,168 said to have been given the university by the late Thomas E. Waggaman a short time before proceedings in bankruptcy were begun against him. The plaintiffs declare that Waggaman permitted the attorneys for the Catholic University, to which he was indebted to the extent of about $900,000, to select choice securities to cover his indebtedness to the institution, although it was his duty to keep all securities intact so that the complainants, as well as the university and other creditors, might have an equitable lien without priority discrimination.

Towards the cost of extending the Union buildings and the furnishing and equipment of the library of Edinburgh University Sir Donald Currie and Mr. Andrew Carnegie have each offered to contribute £6,000, provided £6,000 more is raised locally.

The senate of London University has received from Mr. Martin White two further donations—one to provide a salary of £200 a year for Dr. Edward Westermarck, university lecturer in sociology, for a further period of five years, the other an additional sum of £700 for the establishment for five years of two scholarships a year each of the annual value of £35 and tenable for two years. In connection with Mr. White's benefaction, special courses will be delivered during the session 1906–7 on ethnology by Dr. A. C. Haddon, F.R.S., and on psychology by Dr. J. W. Slaughter, Ph.D. (Clark).

The Medical College of Indiana, the Central College of Physicians and Surgeons and the Fort Wayne College of Medicine have become one, and as such have become a part of Purdue University under the name, 'Indiana Medical College, the School of Medicine of Purdue University.'

It is proposed to establish a chair of geography in the University of Edinburgh.

A readership in meteorology has been instituted in London University.

The council of Nottingham University College has decided to apply for a university charter. The college, which is now in its twenty-fifth year, has over 2,000 students.

The new science buildings of Glasgow University will be opened in the spring of next year by the Prince of Wales.

Mr. Alexander Mackie, M.A., assistant lecturer in education and in philosophy, Bangor University College, has been appointed assistant professor of education in Edinburgh University.

Dr. James P. Hill, late demonstrator in biology and lecturer on embryology in the University of Sydney, has been appointed to the Jodrell chair of zoology in University College, London.

Dr. R. A. Raiss has been appointed associate professor of scientific photography at Lausanne.